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NATIONAL DAM INSPECTION PROGRAM. EBERLE DAM (NDI PA 036, PA-456--ETC(U)
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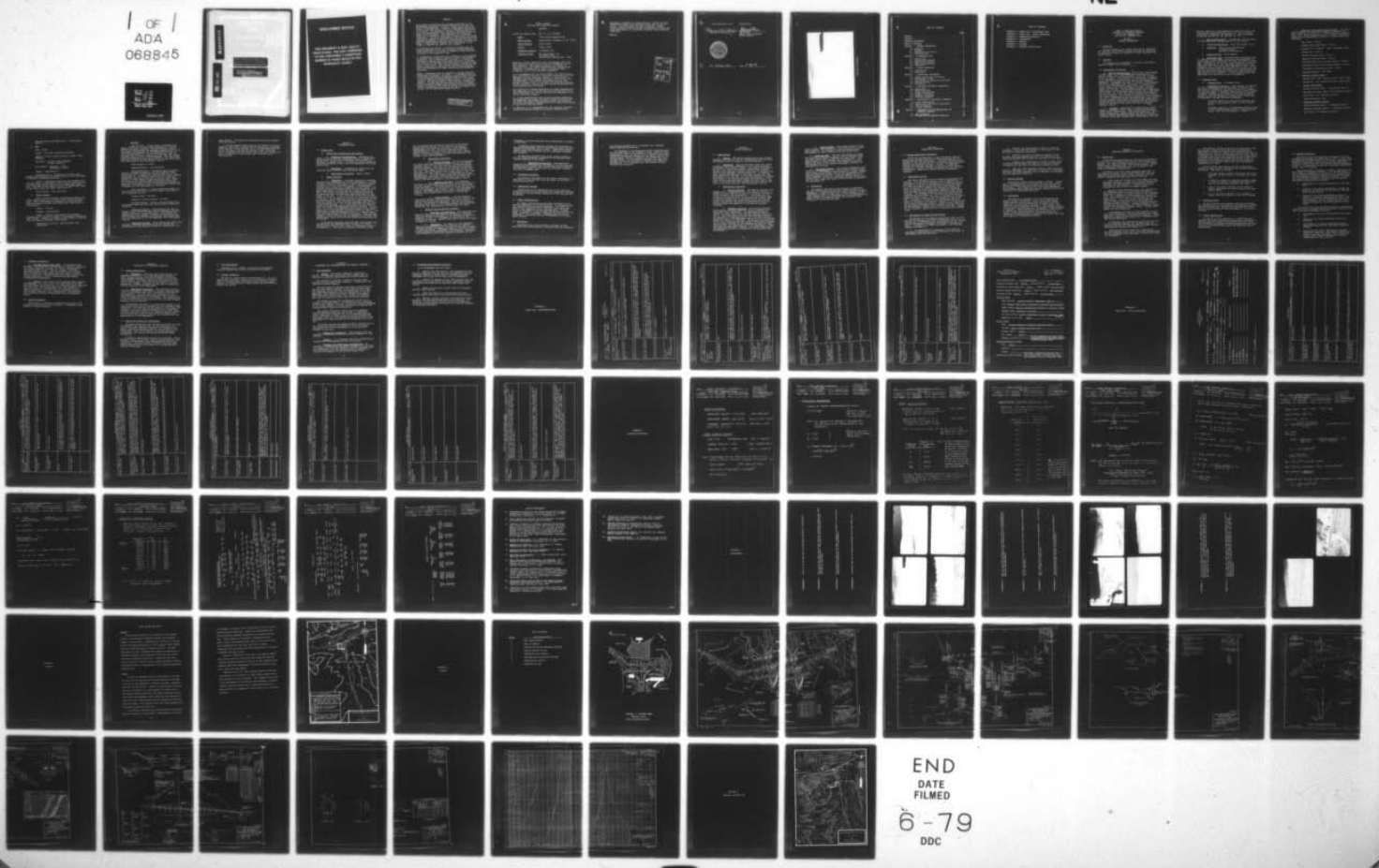

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National Dam Inspection Program. Eberle Dam (NDI PA Ø36, PA-456), Susquehanna River Basin, Closes Creek, Tioga County, Pennsylvania. Phase I Inspection Report.

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I REPORT
National Dam Inspection Program

ABSTRACT

PA-456 Dam (Eberle Dam): NDS I.D. No. PA-00036

Owner:	Tioga County Commissioners
State Located:	Pennsylvania (PennDER I.D. No. 59-63)
County Located:	Tioga County
Stream:	Closes Creek
Inspection Date(s):	6 November 1978
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

Based on a visual inspection, past performance, and available engineering data, the facility is considered to be in good condition. The emergency spillway is capable of discharging the peak inflow resulting from a storm of PMF intensity, as determined by Corps of Engineers (HEC-1) procedures, and is thus considered adequate.

It is recommended that the owner consult with the U.S.D.A., Soil Conservation Service to reevaluate the operation of the emergency spillway discharge channel to insure that all emergency spillway discharges are safely carried away from the embankment. The current configuration on the left abutment indicates that in the event the emergency spillway should discharge, a portion of the flow may be directed over the downstream face of the dam.

The condition of seepage observed on the right abutment near the downstream toe of the dam should be observed and evaluated under higher pool levels and should be addressed in all future inspection reports.

It is also suggested that the burrowing animals inhabiting the embankment be removed and their burrows filled and that the boards and other debris observed within the reservoir and along its banks be removed so as not to impair operations of the service spillway works.

In addition, it is recommended that the operation and maintenance procedures listed in the owners' Operation and

Maintenance Agreement be formalized into a manual and kept available to ensure the continued proper care of the facility. Provision should be made to include a formal warning system providing detailed procedures to protect the lives and property of downstream residents during emergency conditions.

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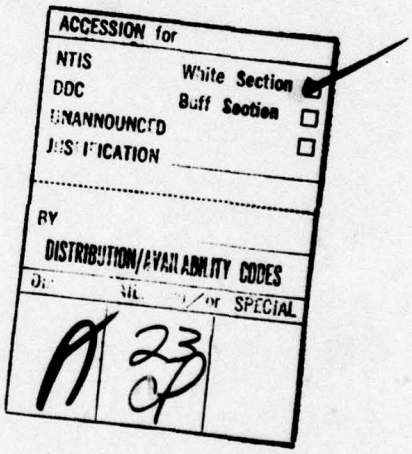


GAI Consultants, Inc.

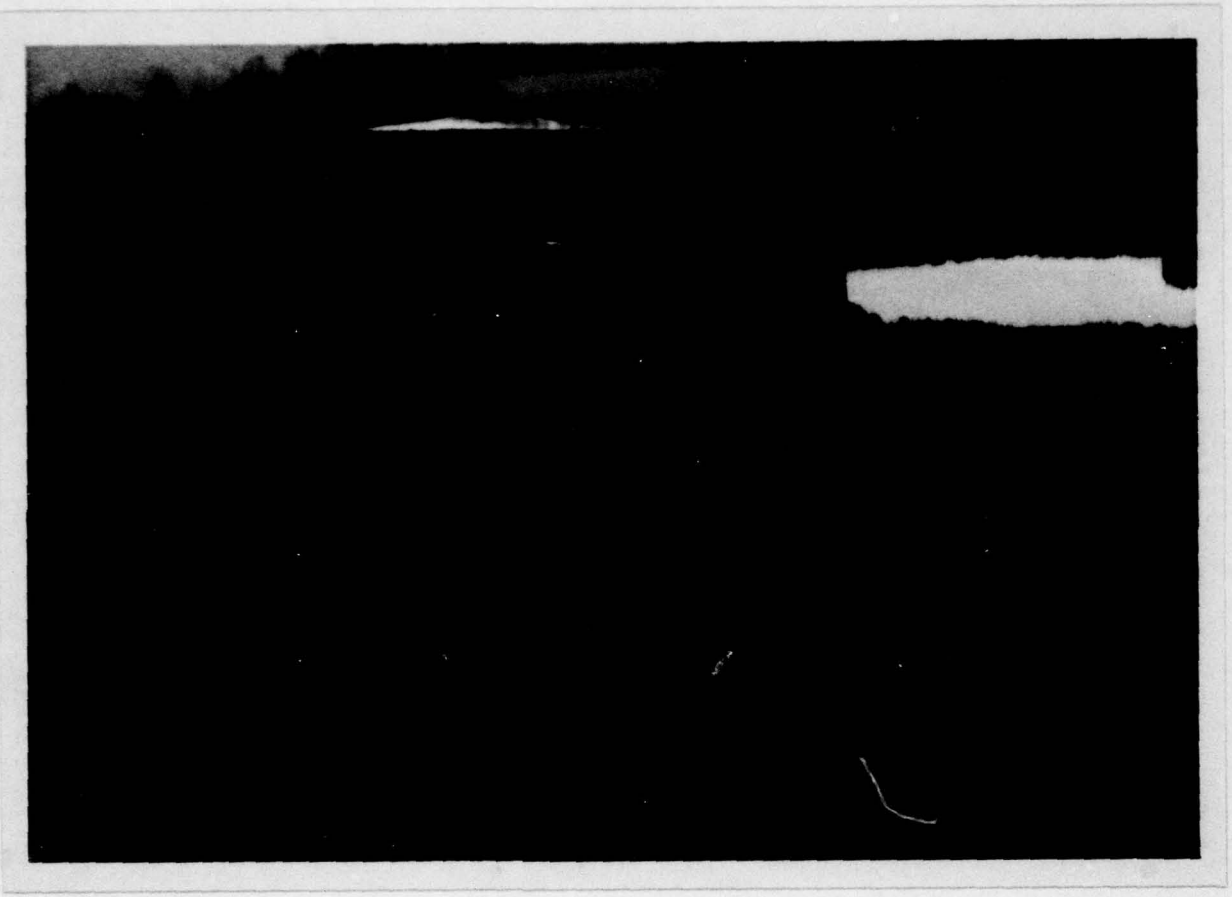
Bernard M. Mihalcin, P.E.

Date 5 FEB 1979

Approved by:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date 3 Mar 79



OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
PA-456 DAM (EBERLE DAM)
NDI# PA-036, PENNDER# 59-63

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

ABSTRACT

1.2 Description of Project.

a. Dam and Appurtenances. PA-456 Dam, locally known as Eberle Dam, is an earth embankment approximately 1130 feet in length with a maximum height of 65 feet (outlet invert to crest). The structure is essentially a standard U. S. Department of Agriculture, Soil Conservation Service design and is equipped with both service and emergency spillways. The service spillway is located on the upstream face of the embankment near its center. It consists of a single stage, reinforced concrete, drop inlet, vertical riser connected to a 30-inch diameter sloping concrete conduit at its base. The emergency spillway is a vegetated earth channel of trapezoidal cross-section with a base width of 100 feet. It is cut into natural ground and located at the left abutment. The facility is provided with a reservoir drain consisting of a 50-foot section of 12-inch diameter B.C.C.M.P. (bituminous-coated corrugated metal pipe) with a 30-inch diameter, half-round, vertical intake fitted with a galvanized steel grating at the upstream toe and discharge outlet at the base of the service spillway riser (see Figures 4 and 6).

ABSTRACT

b. Location. PA-456 Dam is located across Closes Creek, a tributary to Mill Creek, in Westfield Township, Tioga County, Pennsylvania. The borough boundary of Westfield, Pennsylvania, passes through the dam on the left abutment whereas Pennsylvania Route 349 and Mill Creek lie 2,000 and 2,500 feet, respectively, downstream of the site.

The dam, reservoir, and watershed are contained within the Potter Brook, Pennsylvania-New York, U.S.G.S. 7.5 minute topographic quadrangle (see Appendix G). The coordinates of the dam are N41° 54' 35" and W77° 32' 34".

c. Size Classification. Intermediate (65 feet high, 175 acre-feet total storage capacity to top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Tioga County Commissioners
118 Main Street
Wellsboro, Pennsylvania

f. Purpose of Dam. Flood control.

g. Historical Data. PA-456 Dam was constructed last in a system of three dams in the Mill Creek Watershed including Dams PA-454 (Beechwood Lake Dam) and PA-455 (Griffin Dam). Designed by the U.S.D.A., Soil Conservation Service, under the authority of the "Watershed Protection and Fire Prevention Act," the project was completed in 1964. Annual inspection reports dated 1963 through 1978 indicate the dam has been well maintained throughout its 15-year history and that no significant problems or recurring deficiencies are associated with the facility. No major modifications have been made to the structure since its completion.

1.3 Pertinent Data.

a. Drainage Area. 0.6 square miles.

b. Discharge at Dam Site. Daily records of reservoir levels and discharges are not recorded at this facility. The owner is obligated by contract with the SCS to inspect the facility annually and after every major storm and report on possible damage. An estimate of high water is usually included. Discussions with the local SCS representative present during the inspection indicated that to this date, the emergency spillway has never discharged.

Discharge Capacity of the Service Spillway (pool at top of dam elevation 1550) ≈ 65 cfs (design value).

Discharge Capacity of the Emergency Spillway (pool at top of dam elevation 1550) ≈ 3300 cfs (design value); 3800 cfs (see Appendix C, Sheet 8).

c. Elevation (feet above mean sea level). The elevations listed in this section are based on available "as-built" drawings by the U.S.D.A., Soil Conservation Service, dated 3-63. These elevations have been roughly verified by relative field measurements; however, no formal survey was performed.

Top of Dam ≈ 1550.0.

Maximum Design High Water ≈ 1547.5.

Maximum Pool of Record ≈ 1528.7 (September 1975).

Normal Pool ≈ 1518.7.

Service Spillway Crest ≈ 1518.7.

Emergency Spillway Crest ≈ 1545.0.

Upstream Portal Invert Outlet Conduit ≈ 1499.0.

Downstream Portal Invert Outlet Conduit ≈ 1483.4.

Streambed at Centerline of Dam ≈ 1487.3.

Maximum Tailwater - Not known.

d. Reservoir Length (feet).

Maximum Pool ≈ 800 (elevation 1550.0 top of dam).

Normal Pool ≈ 300 (elevation 1518.7 normal pool).

e. Storage (acre-feet).

Service Spillway Crest ≈ 7 (elevation 1518.7).

Emergency Spillway Crest ≈ 125 (elevation 1545.0).

Top of Dam ≈ 175 (elevation 1550.0).

Design Surcharge ≈ 143.

f. Reservoir Surface (acres).

Service Spillway Crest ≈ 1 (elevation 1518.7).

Emergency Spillway Crest ≈ 8 (elevation 1545.0).

Top of Dam ≈ 12 (elevation 1550.0).

Maximum Design High Water Pool ≈ 10 (elevation 1547.5).

g. Dam.

Type - Earth.

Length ≈ 1130 feet (excluding spillway).

Height ≈ 65 feet (outlet invert to crest; field measured.

Top Width - 20 feet (field measured)
18 feet (Figure 4)

Side Slopes - upstream: 3H:1V
downstream: 2.5H:1V

Zoning - (see Figure 4).

Impervious Core - Information available from PennDER files indicates the center section of the embankment is composed of impervious material.

Cutoff - Information available from PennDER files indicates that a cutoff trench with a 10-foot base width and 1:1 side slopes was provided along the embankment centerline. The base of the trench is set at an approximate depth of four feet across the valley (see Figure 4).

Grout Curtain - None indicated.

h. Outlet Conduit.

Type - 30-inch diameter, reinforced concrete, low level conduit located at the base of the service spillway riser. The outlet conduit is designed to discharge flow from the service spillway and/or pond drain (see Figure 6, Photograph 5).

Length ≈ 320 feet.

Closure - Uncontrolled.

Access - Located at the base of the service spillway riser, the outlet conduit is accessible through the riser itself. However, no ladder or other means of reaching the riser base is provided in the design.

Regulating Facilities - None provided, self regulating.

i. Spillway.

Type (service) - Single-stage, reinforced concrete, drop inlet, vertical riser connected to a 30-inch diameter reinforced concrete, sloping discharge conduit. The conduit runs beneath the embankment perpendicular to the centerline and discharges at the downstream toe (see Figure 6 and Photograph 6). The service spillway riser is equipped with an 8-inch diameter aeration tube that extends along the upstream face of the embankment. The tube vents the service spillway riser during flood storage above normal pool (see Figure 6 and Photographs 2 and 5).

Crest Elevation ≈ 1518.7.

Upstream Channel - Not applicable.

Downstream Channel - Discharge from the service spillway is passed through the 30-inch diameter outlet conduit and into a trapezoidal-shaped plunge pool at the downstream toe. Discharge is channeled into a small unlined stream that carries the flow down a natural valley and through a culvert beneath Pennsylvania Route 349. Beyond the culvert, flow passes beneath the Eberle Tannery and joins with Mill Creek near the southern borough boundary of Westfield, Pennsylvania (refer to the Regional Vicinity Map in Appendix G, and Photographs 6, 9 and 10).

Type (emergency) - Unlined vegetated channel cut into natural ground along the left abutment (see Figure 2 and Photographs 1 and 8).

Channel Width ≈ 100 feet.

Breadth of Control Section ≈ 20 feet.

Upstream Channel - Curved, unlined channel with two percent slope away from the control section toward the reservoir.

Downstream Channel - Approximately 100 feet of channel slopes downstream away from the emergency spillway control section at a 3 percent grade. Once through the emergency spillway channel, discharge is passed over the grass-covered left abutment hillside and into Closes Creek near the downstream toe of the embankment (see Photographs 8 and 9).

j. Regulating Outlets. Flows through the service and emergency spillways are uncontrolled and regulated in accordance with the hydraulic principals incorporated into

their designs. No mechanical regulating devices are associated with either.

A 12-inch diameter pond drain has its intake (a 30-inch diameter, half-round, vertical section fitted with galvanized steel grating) at the upstream toe of the embankment and outlet at the base of the service spillway riser. The pond drain is designed with the intent that it be used infrequently and is fitted with a steel plate that is bolted to its discharge end.

SECTION 2
ENGINEERING DATA

2.1 Design Data.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. Hydrologic and hydraulic design data are contained within a comprehensive design report by the Soil Conservation Service which is available in PennDER files. Included are stage-storage and elevation-discharge curves along with hydrograph and flood-routing data.

2. Embankment. Comprehensive design data are contained within the SCS report mentioned above.

3. Appurtenant Structures. Same as above.

b. Design Features.

1. Embankment. Available construction drawings and design data indicate that the dam embankment is a zoned earthfill structure constructed of borrow material consisting mainly of silty and clayey gravels. The embankment consists of two zones and a foundation cut-off trench. The cut-off trench was excavated along the dam centerline to an approximate depth of 4 feet and has a bottom width of 10 feet. The trench is backfilled with impervious material. An impervious core has reportedly been constructed in the center of the dam. It has a top width of 18 feet and side slopes of 2H on 1V. Its top is set at 10 feet below the top of the dam. The remainder of the dam is constructed of more pervious materials. The embankment has been constructed with side slopes of 2.5H:1V on the downstream face and 3H:1V of the upstream slope. An 8.0-foot wide berm has been provided on the upstream face at approximate elevation 1518.2 while the width of the embankment crest is 20 feet. In addition, a 12.5-foot wide berm has been provided on the downstream face at approximately elevation 1523.9 to 1520.3. The berm slopes toward the embankment and at a 1 percent grade from the right abutment to the left abutment. Near the left abutment, runoff from the berm is channeled to a 9-foot wide riprap gutter which carries runoff beyond the downstream toe of the dam.

A foundation drainage system has been incorporated into the design of the embankment which consists of a drain trench 8 feet wide by 4 feet thick (as detailed on Figure 5 in Appendix F). The drain is located at the base of the

fill and extends for 360 feet to the left of the outlet conduit and for 600 feet to the right of the conduit. Approximately 105 feet and 145 feet of 6-inch diameter (perforated) B.C.C.M.P. has been installed within the granular backfill (filter) to the right and left, respectively, of the outlet conduit to facilitate drainage (see Figures 5 and 6 and Photograph 6).

2. Appurtenant Structures.

a) Service Spillway. The service spillway is a drop inlet type structure consisting of a reinforced concrete riser and a 30-inch diameter, reinforced concrete, discharge conduit. The riser is a 23-foot high structure and is located along the upstream toe between Stations 6+00 and 7+00. The intake orifice is two feet wide by one foot high and is set at elevation 1518.7 (see Figures 6 and 7 and Photograph 4). The riser unit is provided with an 8-inch diameter vent pipe which extends along the upstream slope of the embankment and rises to an elevation just above the crest of the dam (see Figure 6 and Photographs 2 and 5).

b) Emergency Spillway. The emergency spillway is a trapezoidal channel cut into natural ground on the left abutment. The design provides for an earth dike along the right side of the spillway to direct the flow away from the embankment (see Figures 1 and 2, and Photograph 1); however, the effectiveness of this dike is questionable, based on field observations (see Figure 1 and Section 3.1.c.2).

c) Outlet Conduit. A 30-inch diameter reinforced concrete, low level conduit has its inlet at the base of the service spillway riser. The outlet conduit carries flow beneath the embankment from the service spillway and/or pond drain to the stream channel just beyond the downstream toe, approximately 320 feet past its inlet.

c. Specific Design Data and Criteria.

1. Hydrology and Hydraulics. The hydrologic and hydraulic design of this facility was based on criteria, data, and methods established in the "National Engineering Handbook" of the U. S. Department of Agriculture, Soil Conservation Service. Specific data and criteria are listed in Section 5, herein.

2. Embankment. All aspects of the embankment design were prepared by the Soil Conservation Service. Available design information includes all the basic elements of earth dam design. Embankment materials and local soils classifications, moisture-density relationships, consolidation, permeability and shear strength parameters are all

discussed in various memoranda and correspondence contained in SCS files.

A complete slope stability analysis was performed on the maximum embankment section using design values attained through field and laboratory testing. Acceptable minimum safety factors were attained for all conditions including full drawdown.

No data were available that could confirm whether or not the design parameters presented in the analysis were actually attained in the field.

3. Appurtenant Structures. The appurtenant structures incorporated into the facility for the most part resemble proven standard Soil Conservation Service designs. No structural design calculations are available, however, from SCS or PennDER files.

2.2 Construction Records.

No records of any aspect of the actual construction of this facility are available from the owner, or the Soil Conservation Service.

2.3 Operational Records.

Conversations with representatives of the local Soil Conservation Service present during the inspection indicated no records of the day-to-day operation of this facility are maintained.

2.4 Other Investigations.

No formal investigations have been performed on this facility subsequent to its construction. In accordance with the "Operation and Maintenance Agreement", the owner performs a site inspection once a year and after each major storm in the company of an SCS representative. A brief report is prepared, a copy of which can be obtained from the owner, local SCS, or PennDER. Remedial work is usually performed in accordance with the recommendations of these annual reports.

2.5 Evaluation.

Engineering data were provided by PennDER and SCS. Sufficient data are available to indicate that the structure

was formally designed and in accordance with accepted modern engineering practice.

The adequacy of the emergency spillway discharge channel was questioned by the inspection team. Based on field observations, there is some doubt as to whether flow being discharged through the channel will be safely carried downstream without partially inundating the downstream toe of the embankment. As the emergency spillway has never discharged, no data are available to confirm this suspicion. Nevertheless, it is suggested that the designer further evaluate the situation.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of this project indicates that the dam and its appurtenances require little maintenance, and are currently in good condition.

b. Embankment. Observations made during the visual inspection reveal the embankment to be in good condition. No evidence of sloughing, erosion, settlements in excess of one foot, or signs of maintenance neglect were observed. Several animal burrows, however, were noted at various locations on the embankment (see Photograph 5). In addition, minor seepage was observed on the right abutment near the downstream toe of the dam. No flow was discernible although the ground in the area was saturated (see Figure 1). The grass covering the embankment slopes had been recently cut prior to the inspection and afforded the field team a clear view of the entire facility (see Photographs 1 and 8).

c. Appurtenant Structures.

1. Service Spillway. The service spillway riser appears to be in good condition. No cracks or signs of weathering were observed in either the interior or exterior of the structure (see Photograph 4). The trash rack attached to the upstream face of the riser did display areas of surface corrosion but is considered minor at this time. Several wood planks and miscellaneous debris were noted within the reservoir and along its banks which could conceivably impair the operation of the service spillway structure.

2. Emergency Spillway. The unlined vegetated earth channel spillway located at the left abutment has reportedly never discharged. Its dimensions generally conform to those shown on the contract drawings (see Figure 2). The earth dike along the right downstream side of the spillway is intended to direct the flow away from the downstream toe of the embankment but may not be of sufficient length to fullfill its function. The existing configuration of the dike, emergency spillway channel and abutment suggests that at least a portion of the emergency spillway flow may discharge over the downstream toe of the embankment. Beyond this possible deficiency, however, the overall condition of the emergency spillway is considered to be excellent (see Photograph 1).

3. Outlet Conduit. The visible portion of the outlet conduit (see Photograph 6) was found to be in excellent condition. No evidence of concrete deterioration, misalignment or other irregularities were discernible.

d. Reservoir Area. The area surrounding the reservoir primarily consists of pasture land of moderate slope and small wooded areas of moderate to steep slope in the upper reaches of the watershed (see Photograph 2). The maximum vertical relief within the watershed as measured from normal pool to the maximum topographic elevation is approximately 740 feet.

e. Downstream Channel. The channel immediately downstream of the embankment is a narrow lightly wooded ravine that carries the discharge from the dam to a culvert passing beneath Pennsylvania Route 349 located approximately 2,000 feet downstream of the dam. Below the highway the flow passes beneath a portion of the Eberle Tannery before joining with Mill Creek (see Regional Vicinity Map in Appendix G and Photograph 10).

3.2 Evaluation.

The overall condition of the facility is excellent. The only deficiencies observed were animal burrows on the embankment, an emergency spillway outlet channel of possibly insufficient length, a small area of minor seepage on the right abutment near the downstream toe of the embankment and debris within the reservoir which could possibly cause clogging of the service spillway.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedures.

PA-456 Dam is essentially a self-regulating facility. Excess inflow passes through the service spillway and is discharged into the stream below. Inflows in excess of the capacity of the service spillway are stored and/or discharged through the emergency spillway. To date, the emergency spillway has not been required to function. There are no regulating or operable devices associated with the facility. Consequently, there are no formal operating procedures required.

4.2 Maintenance of Dam.

The dam is designed to be a virtually maintenance-free facility. Any routine maintenance that is required is performed by Tioga County personnel or by separate contract and often as a result of recommendations by SCS inspectors. No formal maintenance program has been established. The owner is required to maintain the facility in accordance with the "Operation and Maintenance Agreement" dated May 8, 1963, between the Soil Conservation Service and the County of Tioga. The agreement contains provisions requiring the inspection and maintenance of the entire facility and surrounding reservoir area. The owner is required to prepare a report for each inspection and to furnish one copy to the SCS. In addition, a record of all maintenance work performed is required to be readily available for review by the SCS or other authorized agencies. Copies of the "Operation and Maintenance Agreement" are available from both the owner and the Wellsboro, Pennsylvania, office of the SCS. Copies of the inspection reports are also contained within PennDER files.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities, that is, the service and emergency spillways, embankment drains, etc., is carried out in accordance with the provisions of the "Operation and Maintenance Agreement" discussed in Section 4.2 above. In addition to routine maintenance, the agreement requires the owner to:

a. Be responsible for operation of the works of improvement simultaneously with acceptance of the works of improvement from the contractor.

b. Prohibit the installation of gates or other obstructions of any kind being placed in any portion of the principal or emergency spillway(s).

c. Prohibit any works to raise any portion of the spillway above the planned elevation or to deflect or decrease the planned flow through the spillways in any manner.

d. Prohibit the installation of dikes or other structures which may decrease the capacity of the flood channel or deflect the flow from the constructed channel bottom.

e. Take all other necessary steps to insure that the works of improvement are permitted to function in the manner for which they were designed, and are operated in accordance with any applicable state law.

4.4 Warning Systems.

There are no formal warning systems in effect. According to representatives of the owner and local SCS, a high degree of communication and cooperation exists between the two parties. This coupled with an active and dependable Civil Defense Corps reportedly provides adequate warning and protection for downstream residents.

4.5 Evaluation.

The facility is designed to be self-regulating and require minimal maintenance. There are no established formal operation and/or maintenance procedures; however, provisions for such procedures are contained within the "Operation and Maintenance Agreement." The general condition of facility indicates that the present informal program is adequate. Formal manuals are recommended, nevertheless, to ensure the continued proper care of the facility. A formal warning system should be incorporated into the manual(s) providing detailed procedures to protect the lives and property of downstream residents.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

A complete hydrologic/hydraulic analysis as prepared by the U.S.D.A., Soil Conservation Service, is available from PennDER. The report includes design criteria and procedures, stage curves, hydrograph data, and routing analysis. Additional information and design data are contained in SCS files at Harrisburg, Pennsylvania.

According to the "Mill Creek Watershed Work Plan" (a preliminary feasibility study) dated March 1960, the SCS employed the following data, sources, methods, and procedures to determine the hydrologic design criteria.

> "Mill Creek was divided into five damage and four hydrologic reaches. A total of 16 valley sections were surveyed, and stage-discharge relationships were established for each section. A control section was selected for each of the five damage reaches.
>
> Specific flood frequency curves were prepared for the Cowanesque River by a statistical analysis of stream flow records of gauges located on the Cowanesque River and on streams of similar physical characteristics. Peak discharge versus drainage area curves were prepared for 1, 2, 5, 10, 20, 50, and 100 year frequency events. From these curves, discharges for specific drainage areas for all of the above-mentioned frequencies were obtained. A damage frequency relationship was developed from the stage-discharge, stage-damage, and discharge frequency curves. Average annual damage was then determined.
>
> To determine the effect of land treatment in the Mill Creek Watershed, a curve was plotted with percent reduction in peak flood runoff versus frequency. These data were transposed from analysis of Conaserago Watershed in New York state.
>
> To determine the reduction in peak flood flow due to the structural program, the discharge from the uncontrolled area was computed and the maximum release rate from the structure was added to it.
>
> These methods were current Soil Conservation Service procedure at the time a work plan was developed for the Cowanesque River Watershed, of which Mill Creek is a tributary."

The hydraulic design of the facility was based on the then current criteria established by the Pennsylvania Department of Forests and Waters known popularly as the Pennsylvania "C" curve. Design data indicate PA-456 Dam has a drainage area that covers approximately 0.6 square miles. A drainage area of this size required the dam to have spillway facilities capable of discharging a flow of 890 cfs. According to the original design, the dam was capable of discharging the required inflow while still providing a freeboard of 2.7 feet.

Several factors were used by the Soil Conservation Service in their design to determine the various structural elevations. They were as follows:

1. A 50-year sediment deposit determined the invert elevation of the orifice in the riser unit (1518.7 feet).

2. A runoff in excess of a 100-year frequency storm (4 inches of runoff) determined the crest elevation of the emergency spillway (1545 feet).

3. 1.25 x 6 hour point rainfall (9.18 inches of runoff) determined the maximum design high water (1547.5 feet).

4. 2.5 x 6 hour point rainfall (17.21 inches of runoff) set the elevation of the top of the dam.

5.2 Experience Data.

No data pertaining to emergency spillway performance are available as it is reported that the emergency spillway has never discharged. The general appearance of the facility indicates adequate past performance of the service spillway.

5.3 Visual Observations.

On the date of the inspection, no conditions were observed that would indicate the appurtenant structures of the dam could not operate satisfactorily during a flood event although the adequacy of the emergency spillway channel wall in directing flow beyond the downstream toe is questionable.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California.

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam and (2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the inflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge, and the maximum stage of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic/hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as follows:

a. Development of an inflow hydrograph to the reservoir.

b. Routing of the inflow hydrograph through the reservoir.

c. Development of a failure hydrograph based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph to desired downstream locations. The results provide estimates of the peak discharge, time to peak and maximum water surface elevations of failure hydrographs for each location.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams, for Phase I Investigations, the required SDF for this facility is equal to the PMF (probable maximum flood). That is, based on the relative size (intermediate) and hazard potential (high) of PA-456 Dam the facility is required to have sufficient spillway and storage capacities to safely discharge the PMF without overtopping the embankment.

b. Results. The results of the modified HEC-1 analysis (see Appendix C) indicate that under conditions of the PMF, the embankment will not overtop. The peak PMF inflow (2500 cfs) does not exceed the maximum capacity of the emergency spillway (3800 cfs); and, consequently, the storm runoff is safely discharged. The pool rises to a maximum elevation 1548.8 before receding. This corresponds to approximately one foot below the settled embankment crest at elevation 1550.0.

5.6 Spillway Adequacy.

The spillway is capable of discharging the peak inflow resulting from a storm of PMF intensity. Consequently, the spillway is deemed adequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appears to be in good structural condition. Minor seepage, however, was observed emanating from the right abutment-embankment junction several feet above the valley bottom. No surface flow could be detected in the area of the seepage. Although the dam appears to be well maintained, a number of animal burrows were in evidence at various locations on the embankment.

b. Appurtenant Structures. The reinforced concrete riser and pond drain cover were not directly observed since a key to the manhole lock was not provided at the time of the inspection. The drop inlet was functioning and no conditions were observed which suggested that it could not function adequately during a flood event. The discharge end of the 30-inch outlet pipe along with the toe drain outlets appeared in good condition.

The emergency spillway is a grass-lined channel cut in natural ground on the left abutment and has reportedly never functioned. Although the spillway appears to have been constructed to line and grade and appears to be in excellent condition, the lower reach of the emergency spillway channel is poorly defined. The existing condition suggests that flow through the emergency spillway may discharge over the downstream toe of the embankment.

6.2 Design and Construction Techniques.

Available design data and information obtained from SCS and PennDER files indicate that for the most part, the facility has been adequately designed in conformance with modern accepted engineering practice (see Section 2.5 for exceptions). Many of its features have been repeatedly incorporated into similar SCS designs and proven their reliability.

Although no construction records are available, conversations with Mr. Don Lindsey (District Conservationist, SCS, Wellsboro, Pennsylvania), who represented the SCS during construction, revealed nothing of unusual note that would create suspicion as to the integrity of the applied construction techniques.

6.3 Past Performance.

According to Mr. Lindsey, the facility has operated virtually problem free and has functioned as designed.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1, and it is thought that the static stability of the structure is sufficient to withstand minor earthquake induced dynamic forces. However, no investigations or calculations were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, operational history, and available engineering data suggest that the facility is adequately maintained and in good condition.

The spillway is capable of passing the peak inflow resulting from a storm of PMF intensity. Consequently, the spillway is deemed adequate.

The only points of concern pertaining to this facility are the minor seepage observed on the right abutment near the downstream toe of the dam, the possibility of the emergency spillway discharging over the downstream toe of the embankment, the presence of animal burrows in the embankment, and debris (wood planks, etc.) within the reservoir and along its banks that could clog the service spillway.

The seepage on the right abutment may or may not be related to the impoundment. No remedial action is required at this time; however, the area in question should be addressed in all future inspection reports and should be observed and evaluated under higher pool conditions.

The channel designed to safely carry any emergency spillway discharge away from the dam may be inadequate. Visual observation suggests that if the emergency spillway were to discharge, at least a portion of the discharge may be directed over the left abutment sufficiently close to the embankment as to cause erosion of the downstream toe of the dam.

The animal burrows and reservoir debris observed during the inspection should be addressed as a part of routine maintenance and are not considered to be a significant problem at this time.

b. Adequacy of Information. The available data are considered sufficient to make an accurate assessment of the facility.

c. Urgency. It is suggested that the recommendations listed below be implemented as soon as possible.

d. Necessity for Additional Investigations. No additional investigations are deemed necessary at this time. An accurate survey of the emergency spillway discharge channel downstream of the dam centerline may be required to evaluate the adequacy of the spillway channel wall.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Consult with the U.S.D.A., Soil Conservation Service, to reevaluate the operation of the emergency spillway discharge channel to insure that all emergency spillway discharges are safely carried away from the embankment.

b. Address the seepage on the right abutment near the downstream toe of the dam in all future inspection reports and observe and evaluate the condition under higher pool levels.

c. Remove the burrowing animals from the embankment and fill their burrows.

d. Clear the reservoir of wood planks and other floating debris that could clog the service spillway works.

e. Develop a formal operation and maintenance manual to ensure the continued proper care of the facility. In addition, a formal warning system should be included providing detailed procedures to protect the lives and property of downstream residents.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: PA-456 (Eberle Dam)

NDI#: PA-036 PENNDER# : 59-63

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 036
PERSONS INTERVIEWED AND TITLE	1. Don Lindsey (SCS - District Conservationist) 2. Dennis Carmin (SCS - Area Engineer)
REGIONAL VICINITY MAP	Potter Brook, PA. - N.Y., 7.5 minute topographic quadrangle. (See Appendix G. Regional Vicinity Map)
CONSTRUCTION HISTORY	Construction records are not available. Mr. Lindsey represented the SCS during construction of this facility. Conversations with him indicated that the project was completed ahead of schedule without any major problems.
AVAILABLE DRAWINGS	A complete set of "as-built" drawings by the SCS dated 3-63 are available from the owner and the SCS at Harrisburg and Wellsboro. Drawings available from PennDER are not marked "as-built" but nevertheless appear to be identical.
TYPICAL DAM SECTIONS	Figure 4, Appendix F
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	Figures 2, 4, and 6, Appendix F

ITEM	REMARKS NDI# PA - 036
SPILLWAY: PLAN SECTION DETAILS	Figures 6 and 7, Appendix F (service) Figures 2 and 3, Appendix F (emergency)
OPERATING EQUIPMENT PLANS AND DETAILS	N/A
DESIGN REPORTS	Complete design folder as prepared by the U.S.D.A., Soil Conservation Service (SCS) entitled, "Mill Creek Watershed Protection Project, Tioga County, PA, PA-456 is available from PennDER."
GEOLOGY REPORTS	Design Folder (see above).
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	Design Folder (see above).
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Design Folder (see above). Also see Figures 2 and 3, Appendix F. Also, as-built drawing 2 of 11, "Plan of Storage Areas" (not included in Appendix F).

ITEM	REMARKS NDI# PA - 036
BORROW SOURCES	As-built drawing 2 of 11, "Plan of Storage Areas" (not included in Appendix F).
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Yearly inspection reports as prepared by the owner (Tioga County Commissioners) are available from PennDER.
HIGH POOL RECORDS	Highest pool level recorded to date occurred in 1975 when the water reached elevation 1528.7 or 16.3 feet below the emergency spillway crest.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.

ITEM	REMARKS	NDI# PA - 036
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	Records - Annual maintenance report filed (available from owner).	
OPERATION: RECORDS MANUAL	No operating mechanisms.	
OPERATIONAL PROCEDURES	Facility is self regulating; no formal operating procedures are necessary.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	No formal warning systems are in effect. According to representatives of the owner and local SCS, a high degree of communication and cooperation exists between the two parties. This coupled with an active and dependable Civil Defense Corps reportedly provides adequate warning and protection for downstream residents.	
MISCELLANEOUS		

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-036
PENN DER ID # 59-63

SIZE OF DRAINAGE AREA: 0.6 square miles

ELEVATION TOP NORMAL POOL: 1518.7 STORAGE CAPACITY: 7 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: 1545.0 STORAGE CAPACITY: 125 acre-feet

ELEVATION MAXIMUM DESIGN POOL: 1547.5 STORAGE CAPACITY: 150 acre-feet

ELEVATION TOP DAM: 1550.0 STORAGE CAPACITY: 175 acre-feet

SPILLWAY DATA

CREST ELEVATION: service (1518.7); emergency (1545.0)

TYPE: service (drop inlet); emergency (vegetated earth channel)

CREST LENGTH: service (rectangular orifice, 2' wide by 1' high)

CHANNEL WIDTH: emergency (100 feet)

SPILLOVER LOCATION: service (embankment center); emergency (left abutment)

NUMBER AND TYPE OF GATES: None

OUTLET WORKS

TYPE: 30-inch diameter reinforced concrete conduit

LOCATION: base of service spillway riser

ENTRANCE INVERTS: 1499.0

EXIT INVERTS: 1483.4

EMERGENCY DRAWDOWN FACILITIES: 12-inch diameter B.C.C.M.P. pond drain located at upstream toe and discharges into front face base of service spillway riser

HYDROMETEOROLOGICAL GAGES

TYPE: None

LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Not known - emergency spillway has never discharged. Maximum high water was reached in 1975 at elevation 1528.7

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM PA-456 (Eberle Dam) STATE Pennsylvania COUNTY Tioga

NDI# PA - 036 PENNDER# 59-63

TYPE OF DAM Earth SIZE Intermediate HAZARD CATAGORY High

DATE(S) INSPECTION 6 November 1978 WEATHER Sunny and warm TEMPERATURE 75° @ 1:00 PM

POOL ELEVATION AT TIME OF INSPECTION 1518.7 M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. M. Mihalcin		Don Lindsey (SCS Dist. Conserv.)
W. J. Veon		Dennis Carmin (SCS Area Engr.)
K. H. Khilji		
S. R. Michalski		
D. L. Bonk		

RECORDED BY D. L. Bonk

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good condition.
RIPRAP FAILURES	No riprap protection has been included in the design of this facility.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition. (See "Damp Areas," page 3 of 8.)

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	A small wet area was observed at the downstream toe near the junction of the embankment and right abutment and approximately 10 feet above the invert of the discharge end of the outlet conduit.
ANY NOTICEABLE SEEPAGE	The only observed area of seepage is associated with the damp area described above.
STAFF GAGE AND RECORDER	None observed.
DRAINS	Two 6-inch diameter CMP toe drains were observed at the downstream toe on either side of the outlet conduit. Both drains were discharging at a small trickling rate.
ANIMAL BURROWS	Several animal burrows were observed across both the upstream and downstream slopes of the embankment which should be filled and the animals removed.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA -036
INTAKE STRUCTURE	A small reinforced concrete, "drop inlet" type riser is located near the center of the upstream face of the embankment at approximately 30 feet below the crest. The observed condition of the intake structure is good with little sign of concrete deterioration evident.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	The discharge end of the 30-inch diameter reinforced concrete outlet conduit was observed projecting through the downstream face at the base of the toe in a cantilever position. The visible portion of the conduit displayed minor deterioration in the form of spalling and scaling at the extreme end. No evidence of stress cracking was observed.
OUTLET STRUCTURE	None observed.
OUTLET CHANNEL	Small, irregularly shaped, rock-lined channel with relatively high side slopes and a steep channel slope. Side slopes are covered with large trees that are not thickly bunched. The channel is approximately 1/2 mile in length and converges with Mill Creek downstream.
GATE(S) AND OPERATIONAL EQUIPMENT	There are no operating mechanisms associated with this facility.
RESERVOIR DRAIN	Submerged and not observed.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
TYPE AND CONDITION	Grass-lined trapezoidal shaped earth channel in good condition located at the left abutment.
APPROACH CHANNEL	Grass-lined, roughly trapezoidal-shaped channel sloping at 2 percent toward the reservoir.
SPILLWAY CHANNEL AND SIDEWALLS	Grass-covered slopes in good condition.
STILLING BASIN PLUNGE POOL	None observed.
DISCHARGE CHANNEL	The emergency spillway is designed to divert discharge away from the embankment, over the left downstream hillside, and into the stream channel at the base of the valley. The visual inspection raised some question as to whether or not the discharge can be effectively diverted away from the downstream toe as intended.
BRIDGE AND PIERS	None observed.
EMERGENCY GATES	None observed.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
TYPE AND CONDITION	Reinforced concrete, "drop inlet" type riser with a 30-inch diameter reinforced concrete, low level, conduit.
APPROACH CHANNEL	None. Reservoir contains wood planks and other debris which could clog service spillway. Planks and debris should be removed.
OUTLET STRUCTURE	None observed.
DISCHARGE CHANNEL	See "outlet channel", page 4 of 8.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
MONUMENTATION SURVEYS	None observed.
OBSERVATION WELLS	None observed.
WEIRS	None observed.
PIEZOMETERS	None observed.
OTHERS	None observed.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 036
SLOPES: RESERVOIR	Moderate grass-covered slopes confine the maximum reservoir pool to a small area. The slopes surrounding the reservoir are primarily pastureland with the majority of the tree-covered areas located near the top of the local hills.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is crossed by a small single lane roadway bridge several hundred feet beyond the embankment. Further downstream the stream is diverted beneath Pennsylvania Route 349 and a local factory.
SLOPES: CHANNEL VALLEY	Steep slopes, lightly wooded.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Only one large home is adjacent to West Beech Woods Run immediately below the embankment. The stream, however, passes directly beneath the Eberle Tannery less than one mile downstream, which happens to be the major employer in the Borough of Westfield (population ≈ 2000 persons). An embankment breach would thus likely cause major economic damage, possibly resulting in the loss of many lives.

APPENDIX C

HYDRAULICS/HYDROLOGY

SUBJECT DAM SAFETY INSPECTION
PA-456 (EBERLE DAM)

BY EJM DATE 11-17-78 PROJ. NO. 79-617-036

CHKD. BY DLB DATE 12-19-78 SHEET NO. 1 OF 12

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DAM STATISTICS

MAXIMUM HEIGHT ≈ 65.0 FEET (FIELD VERIFIED)

DRAINAGE AREA ≈ 0.61 SQ. MI. (SEE NOTE AT BOTTOM OF PAGE)

STORAGE CAPACITY ≈ 175 AC-FT (SEE SHEET 4 OF 12)
@ TOP OF DAM (EL. 1550)

SIZE CLASSIFICATION

DAM SIZE : INTERMEDIATE (REF 1, TABLE 1)

HAZARD RATING : HIGH (FIELD OBSERVATION)

REQUIRED SDF : PMF (REF 1, TABLE 3)

NOTE: PLANIMETERED FROM THE POTTER BROOK, PA.-N.Y., 7.5 MINUTE SERIES, U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP (PHOTOREVISED 1969)

$DA \approx 4.25 in^2$ (DA : DRAINAGE AREA)

$DA \approx 4.25 in^2 (2000 ft/in)^2 (1 mile/5280 ft)^2$

$DA \approx 0.61$ SQ. MI.

SUBJECT DAM SAFETY INSPECTION
PA-456

BY EJM DATE 11-8-78 PROJ. NO. 78-617-036

CHKD. BY DLB DATE 12-19-78 SHEET NO. 2 OF 12

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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE (L) ≃ 0.97 Mi

L_{CA} ≃ 0.48 Mi

[VALUES OF L AND L_{CA} ARE FROM U.S.G.S. 7.5 MINUTE SERIES QUADS]

NOTE: ALL VARIABLES ARE DEFINED IN REFERENCE 2 IN THE SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH".

$C_t = 0.8$

$C_p = 0.49$

[SUPPLIED BY COE; ZONE 16, SUSQUEHANNA RIVER BASIN]

t_p = SNYDER'S STANDARD LAG $= 0.8 (L \times L_{CA})^{0.3}$

$= (0.8)[(0.97)(0.48)]^{0.3}$

$= 0.64$ HR

SUBJECT DAM SAFETY INSPECTION
PA-456

BY WJV DATE 12/6/78 PROJ. NO. 78-617-036

CHKD. BY DLB DATE 12/19/78 SHEET NO. 3 OF 12

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PMP CALCULATIONS

- RAINFALL INDEX = 22.5 INCHES (FIG 2, REF 9)
  (CORRESPONDING TO A DURATION OF 24-HOURS AND AN AREA OF 200 SQ MI)

- GEOGRAPHIC FACTOR = 100% (FIG 1, REF 9)
  (CORRESPONDING TO A LONGITUDE OF 77° 32' AND A LATITUDE OF 41° 55')

- DA = 0.61 SQ MI < 10 SQ MI ⇒ ASSUME 10 SQ MI DATA CAN EFFECTIVELY REPRESENT THE 0.61 SQ MI AREA

DURATION (HOURS)	PERCENT OF INDEX RAINFALL (%)
6	117.5
12	127.0
24	136.0
48	142.5

NOTE: THE CORPS OF ENGINEERS RECOMMENDS THE ANALYSIS BE BASED ON A 72-HR DURATION STORM. SUCCESSIVE TRIAL HAVE REVEALED A 48-HR STORM WITH 15-MINUTE TIME INTERVALS TO PROVIDE GREATER ACCURACY. HEC-1 REQUIRES 30-MINUTE INTERVALS FOR A 72-HR STORM. THIS HAS BEEN FOUND TO PRODUC MISLEADING RESULTS FOR VERY SMALL DRAINAGE AREAS.

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE, AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM HITTING A SMALLER BASI CORRESPONDING TO DA = 0.61 SQ MI (< 10 SQ MI) = 0.90
  (REF 4, PG 48)

SUBJECT DAM SAFETY INSPECTION
PA-456

WJV DATE 12/6/78 PROJ. NO. 78-617-036

CHKD. BY DLB DATE 12/19/78 SHEET NO. 4 OF 12

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ELEVATION STORAGE RELATIONSHIP

ELEVATION - STORAGE INFORMATION OBTAINED FROM THE DESIGN DRAWINGS OF PA-456 (DRAWING No. PA-456-P)

ELEVATION (FEET)	STORAGE ABOVE NORMAL POOL (ACRE-FEET)
1518.7	0.0
1526.3	15.0
1530.0	27.0
1536.0	55.0
1540.0	79.0
1545.0	118.0
1546.0	128.0
1547.0	138.0
1548.0	148.0
1549.0	158.0
1550.0	168.0
1551.0	178.0

NOTE: ACCORDING TO THE PROJECT DESIGN FOLDER, PERMANT POOL STORAGE UP TO EL 1518.7 (NORMAL POOL) ≃ 7 AC-FT. THUS TOTAL STORAGE UP TO EL 1550 (TOP OF DAM) ≃ 175 AC-FT.

SUBJECT DAM SAFETY INSPECTION
PA-456 DAM

BY DLB DATE 12-6-78 PROJ. NO. 78-617-C36

CHKD. BY WJV DATE 12/20/78 SHEET NO. 5 OF 12

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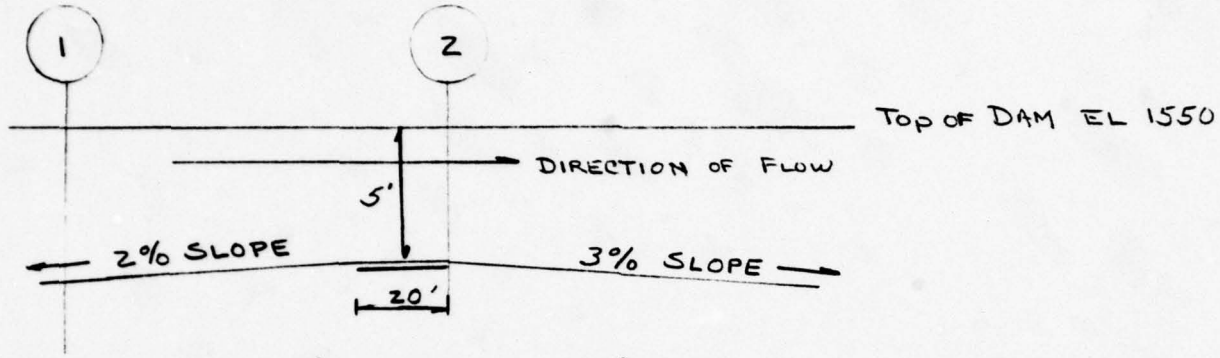
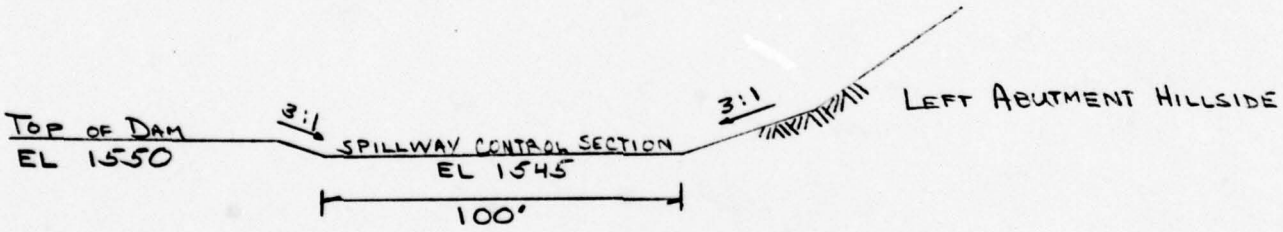
SPILLWAY CAPACITY : EMERGENCY SPILLWAY



(NOT TO SCALE)



(SCALE 1 IN = 50 FT)

NOTE: ALL DIMENSIONS AND ELEVATIONS WERE OBTAINED FROM "AS-BUILT" DRAWINGS BY THE U.S.D.A., SOIL CONSERVATION SERVICE, ENTITLED;

"MILL CREEK WATERSHED PROJECT"
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA

THE ABOVE DIMENSIONS AND ELEVATIONS HAVE BEEN ROUGHLY VERIFIED THROUGH FIELD MEASUREMENTS

SUBJECT DAM SAFETY INSPECTION
PA-456 DAM

BY DLB DATE 12-6-78 PROJ. NO. 78-617-036

CHKD. BY WJV DATE 12/20/78 SHEET NO. 6 OF 12

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ASSUME THE FLOW TO BE SUPERCRITICAL BELOW SECTION 2 AND TO PASS THROUGH CRITICAL DEPTH AT SECTION 2.

H_s = SPECIFIC ENERGY HEAD = $y + V^2/2g$ (REF 7, pg 41, EQ 3-8)

AT SECTION ①, V IS NEGLIGIBLE $\Rightarrow$ $H_s = H = 5'$

AT SECTION ②, $H_s = y_c + V_c^2/2g$

where $y_c \Rightarrow$ CRITICAL DEPTH OF FLOW
$V_c \Rightarrow$ CRITICAL VELOCITY

$y_c + V_c^2/2g = 5'$

AT CRITICAL DEPTH $V_c^2/2g = \Delta_c/2$ (REF 7, pg 43, EQ 3-10)

where Δ_c = HYDRAULIC DEPTH = $\frac{\text{AREA}}{\text{TOP WIDTH}} = \frac{A_c}{W_c}$

$A_c = 100\,y_c + 3y_c(y_c) = 3y_c^2 + 100y_c$

$W_c = 100 + 6y_c$

$\therefore\ y_c + \frac{\Delta_c}{2} = y_c + \left[\left(\frac{3y_c^2 + 100y_c}{100 + 6y_c}\right)\Big/ 2\right] = 5$

SOLVE FOR y_c

$y_c + \frac{3y_c^2 + 100y_c}{200 + 12y_c} = 5$

SUBJECT DAM SAFETY INSPECTION
PA-456 DAM

BY DLB DATE 12-6-78 PROJ. NO. 78-617-036

CHKD. BY WJV DATE 12/20/78 SHEET NO. 7 OF 12

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$$200y_c + 124y_c^2 + 34y_c^2 + 100y_c = 1000 + 60y_c$$

$$154y_c^2 + 240y_c - 1000 = 0$$

$$1.54y_c^2 + 24y_c - 100 = 0$$

$$y_c = \frac{-24 + \sqrt{(24)^2 - 4(1.5)(-100)}}{2(1.5)}$$ } QUADRATIC EQUATION

$$y_c = 3.43'$$

$$V_c^2/2g = \frac{3y_c^2 + 100y_c}{200 + 12y_c} = \frac{3(3.43')^2 + 100(3.43')}{200 + 12(3.43')} = 1.57$$

$$V_c = [1.57\,(2)(32.2)]^{1/2}$$

$$V_c = 10.05 \text{ fps}$$

$$A_c = 3(3.43')^2 + 100(3.43') = 378 \text{ FT}^2$$

Q_c = CRITICAL DISCHARGE = $V_c A_c = 10.05 \text{ fps}\,(378 \text{ FT}^2)$

$Q_c = 3799 \text{ CFS} \simeq 3800 \text{ CFS}$

DETERMINE THE CRITICAL SLOPE REQUIRED TO CONVEY THIS FLOW

$$Q_c = \frac{1.49}{n} A_c R_c^{2/3} S^{1/2}$$

SUBJECT DAM SAFETY INSPECTION
PA-456 DAM

BY DLB DATE 12-6-78 PROJ. NO. 78-617-036

CHKD. BY WJV DATE 12/20/78 SHEET NO. 8 OF 12

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$$R_c = \frac{\text{AREA}}{\text{WETTED PERIMETER}} = \frac{378\ ft^2}{100\ ft + 2\left[(3)(3.43\ ft)^2\right]^{1/2}} = 3.11\ FT$$

$A_c = 378\ FT^2$

n = MANNING'S COEFFICIENT = 0.032 (REF 15: pg 7-12 AND 7-13)

$$\left[\frac{3800\,(0.032)}{1.49\,(378)(3.11)^{2/3}}\right]^2 = S$$

$S = 1.01\ \%$

CRITICAL SLOPE IS LESS THAN ACTUAL SLOPE

$\therefore$ $1.01\ \% < 3\%$

SUPERCRITICAL FLOW WILL OCCUR BELOW SECTION 2

MAXIMUM SPILLWAY CAPACITY $Q \simeq 3800$ CFS

SUBJECT DAM SAFETY INSPECTION
PA 456 DAM

BY WJV DATE 12/15/78 PROJ. NO. 78-617-036

CHKD. BY DLB DATE 12-19-78 SHEET NO. 9 OF 12

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SPILLWAY RATING CURVE

CRITICAL DEPTH RATING CURVE FOR PREVIOUSLY SKETCHED TRAPEZOIDAL SPILLWAY CONTROL SECTION, BASED ON THE PROCEDURE GIVEN IN THE SPILLWAY CAPACITY CALCULATIONS

	ELEVATION (FEET)	* H (FEET)	Q (CFS)
CREST OF SPILLWAY -	1545.0	0	0
	1545.5	0.5	108
	1546.0	1.0	314
	1546.5	1.5	595
	1547.0	2.0	909
	1547.5	2.5	1230
	1548.0	3.0	1706
	1548.5	3.5	2161
	1549.0	4.0	2671
	1549.5	4.5	3218
TOP OF DAM -	1550.0	5.0	3901

* H = HEIGHT OF RESERVOIR SURFACE ABOVE SPILLWAY CREST ELEVATION

SUBJECT DAM SAFETY INSPECTION PA 456

BY WTV DATE 1/12/79

CHKD. BY DLB DATE 1/12/79 SHEET NO. 10 OF 12

PROJ. NO. 73-077-036

OVERTOPPING ANALYSIS: HEC-1- DAM INPUT / OUTPUT

```
DAM SAFETY INSPECTION PENNSYLVANIA 456
PA--456  DAM--  TIOGA COUNTY COMMISSION
15-MINUTE TIME STEP AND 48-HOUR RAINFALL DURATION

                    JOB SPECIFICATION
 NO     NHR    NMIN    IDAY    IHR    IMIN    METRC    IPLT    IPRT    NSTAN
192       0      15       0      0       0        0       0       0        0
                      JOPER     NW     LROPT    TRACE
                          5      0         0        0


                MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 1 NRTIO= 6 LRTIO= 1
          RTIOS=    .20    .30    .40    .50    .75   1.00

**********      **********      **********      **********      **********

                    SUB-AREA RUNOFF COMPUTATION

     INFLOW TO RESERVOIR

                    ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE   IAUTO
                        1       0       0       0      0       0       1       0       0

                    HYDROGRAPH DATA
     IHYDG    IUHG    TAREA    SNAP    TRSDA    TRSPC    RATIO   ISNOW   ISAME   LOCAL
         1       1      .61    0.00      .61     0.00    0.000       0       1       0

                    PRECIP DATA
                    SPFE     PRS      R6      R12      R24      R48      R72      R96
                    0.00   22.50  117.50   127.00   136.00   142.50     0.00     0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800

                    LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .05    0.00    0.00

                    UNIT HYDROGRAPH DATA
                TP=    .64    CP= .49    NTA=  0

                    RECESSION DATA
                STRTQ=   -1.50    QRCSN=    -.05    RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 2.53 AND R= 3.68 INTERVALS

     UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG=    .64 HOURS, CP=  .49  VOL= 1.00
    66.     213.     294.     242.     164.     140.     106.      81.      62.      47.
    36.      27.      21.      16.      12.       9.       7.       5.       4.       3.
     2.

                    END-OF-PERIOD FLOW
  HO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q       HO.DA  HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q
                                                                                SUM   25.65   23.35    2.30    36696.
                                                                                     ( 652.)( 593.)(  58.)( 1039.12)

                        PEAK    6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
          CFS           2500.     1262.      381.       191.         36670.
          CMS             71.       36.       11.         5.          1038.
          INCHES                  19.24     23.22      23.30         23.30
          MM                     488.67    589.82     591.83        591.83
          AC-FT                     626.      755.       758.          758.
          THOUS CU M                772.      931.       935.          935.
```

INITIAL AND CONSTANT RAINFALL LOSS RATES, OBTAINED FROM THE BALTIMORE DISTRICT COE

BASEFLOW GENERATION PARAMETERS, OBTAINED FROM THE BALTIMORE DISTRICT COE

SUBJECT DAM SAFETY INSPECTION

PA - 456

BY WJV DATE 1/12/77 PROJ. NO. 73-677-033

CHKD. BY DLB DATE 1/12/77 SHEET NO. 11 OF 12

GAI CONSULTANTS, INC

Engineers • Geologists • Planners
Environmental Specialists

HYDROGRAPH ROUTING

ROUTE THRU RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	1545.00	1545.50	1546.00	1546.50	1547.00	1547.50	1548.00	1548.50	1549.00
	1550.00								
FLOW	0.00	108.00	314.00	585.00	909.00	1280.00	1706.00	2161.00	2671.00
	3801.00								
CAPACITY=	0.	15.	27.	55.	79.	110.	128.	138.	148.	158.
	168.	178.							
ELEVATION=	1519.	1526.	1530.	1536.	1540.	1545.	1546.	1547.	1548.	1549.
	1550.	1551.							

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1545.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1550.0	0.0	0.0	0.

STATION 101, PLAN 1, RATIO 6

PEAK OUTFLOW IS 2411. AT TIME 40.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2411.	1206.	321.	161.	30831.
CMS	68.	34.	9.	5.	873.
INCHES		18.39	19.59	19.59	19.59
MM		467.10	497.60	497.60	497.60
AC-FT		598.	637.	637.	637.
THOUS CU M		738.	786.	786.	786.

SUBJECT DAM SAFETY INSPECTION
PA 456

BY WJV DATE 1/12/79 PROJ. NO. 78-617-036

CHKD. BY DLB DATE 1/12/79 SHEET NO. 12 OF 12

GAI CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1518.70	1545.00	1550.00
STORAGE	0.	118.	168.
OUTFLOW	0.	0.	3801.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
.20	1545.71	0.00	125.	194.	0.00	42.50
.30	1546.41	0.00	132.	538.	0.00	41.00
.40	1547.00	0.00	138.	907.	0.00	40.50
.50	1547.38	0.00	142.	1194.	0.00	40.50
.75	1548.11	0.00	149.	1805.	0.00	40.50
1.00	1548.75	0.00	155.	2411.	0.00	40.50

LIST OF REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams," prepared by Department of the Army Office of the Chief of Engineers, Washington, D. C. (Appendix D).

2. "Unit Hydrograph Concepts and Calculations," by Corps of Engineers, Baltimore District (L-519).

3. "Seasonal Variation of Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Duration of 6, 12, 24, and 48 Hours," Hydrometeorological Report No. 33, prepared by J. T. Riedel, J. F. Appleby and R. W. Schloemer Hydrologic Service Division Hydrometeorological Section, U. S. Department of the Army, Corps of Engineers, Washington, D. C., April 1956.

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5. Handbook of Hydraulic, H. W. King and E. F. Brater, McGraw-Hill, Inc., New York, 1963.

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8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.

9. "Probable Maximum Precipitation Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometeorological Report 40, prepared by H. V. Goodyear and J. T. Riedel Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May 1965.

10. Flood Hydrograph Package (HEC-1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army Corps of Engineers Dams, California, July 1978.

11. "Simulation of Flow Through Broad Crest Navigation Dams with Radial Gates," R. W. Schmitt, U. S. Army Corps of Engineers, Pittsburgh District.

12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

13. Applied Hydraulics in Engineering, Morris, Henry M. and Wiggert, James M., Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.

14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.

15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C. 1969.

APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 View of PA 456 Dam and the emergency spillway (foreground).

PHOTOGRAPH 2 View from the crest of the dam looking southwest toward the upper reaches of the watershed. The pipe in the foreground vents the service spillway.

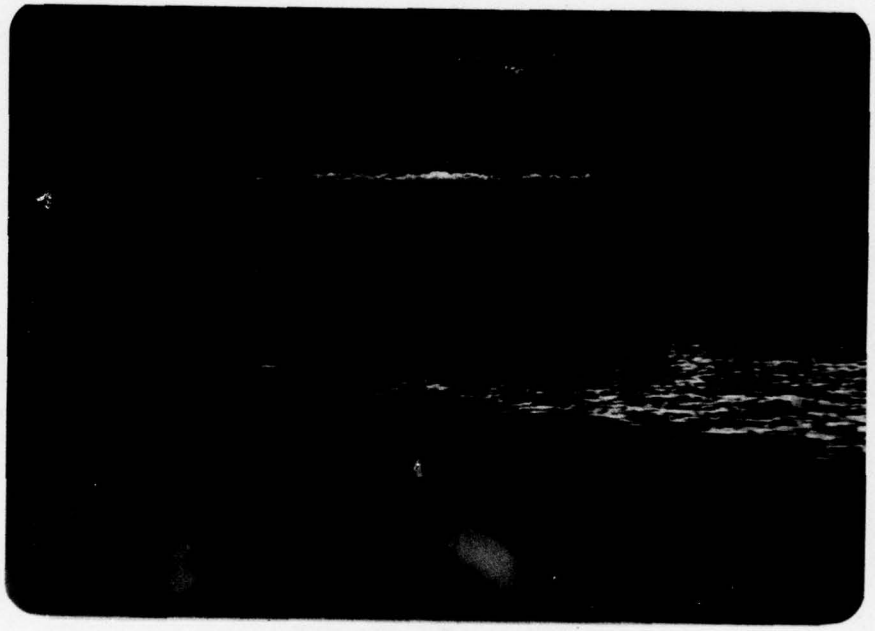
PHOTOGRAPH 3 View from the crest of the dam, looking northeast at the valley immediately downstream of the impoundment.

PHOTOGRAPH 4 Close-up view of the service spillway and inlet trash rack.

1

2

3



4

PHOTOGRAPH 5 View of an animal burrow on the upstream face of the embankment. The vent pipe in the upper right hand corner is located near the crest of the embankment.

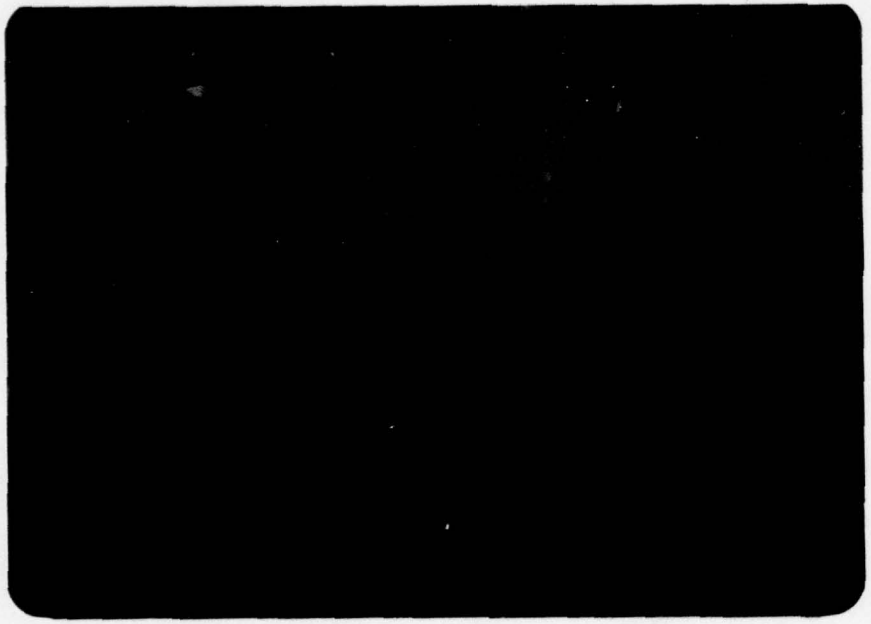
PHOTOGRAPH 6 View of the outlet pipe and toe drain pipes immediately downstream of the embankment.

PHOTOGRAPH 7 View looking north along the crest of the embankment. The impoundment is shown at normal pool.

PHOTOGRAPH 8 View looking south from the left abutment showing emergency spillway earth dike (center of photograph).

5

6



7

8

PHOTOGRAPH 9 View looking downstream of the dam. The smoke stacks in the background are part of a leather tanning factory located within Westfield Borough. Discharge from the dam passes from right to left through a small valley located within the trees just above the center of the photograph.

PHOTOGRAPH 10 View 2,000 feet downstream of the embankment showing the culvert which passes the flow beneath Pennsylvania Route 349 at the southern boundary of the Borough of Westfield. The leather tanning factory is located across the road on the right side of the photograph.

9

10

APPENDIX E

GEOLOGY

SITE GEOLOGY AND SOILS

General

PA-456 Dam and Reservoir are located on the southern border of the borough of Westfield within the northwest corner of Tioga County. Geophysically, the site is located within the glaciated portion of the Allegheny High Plateaus Section of the Appalachian Plateaus Province. The area including the site, watershed and adjacent surroundings is covered by glacial soils deposited during the most recent period of continental glaciation. Underlying the thick glacial deposits, bedrock is most likely composed of nearly horizontal shales and sandstones of the Chemung Formation of Devonian age.

Detail

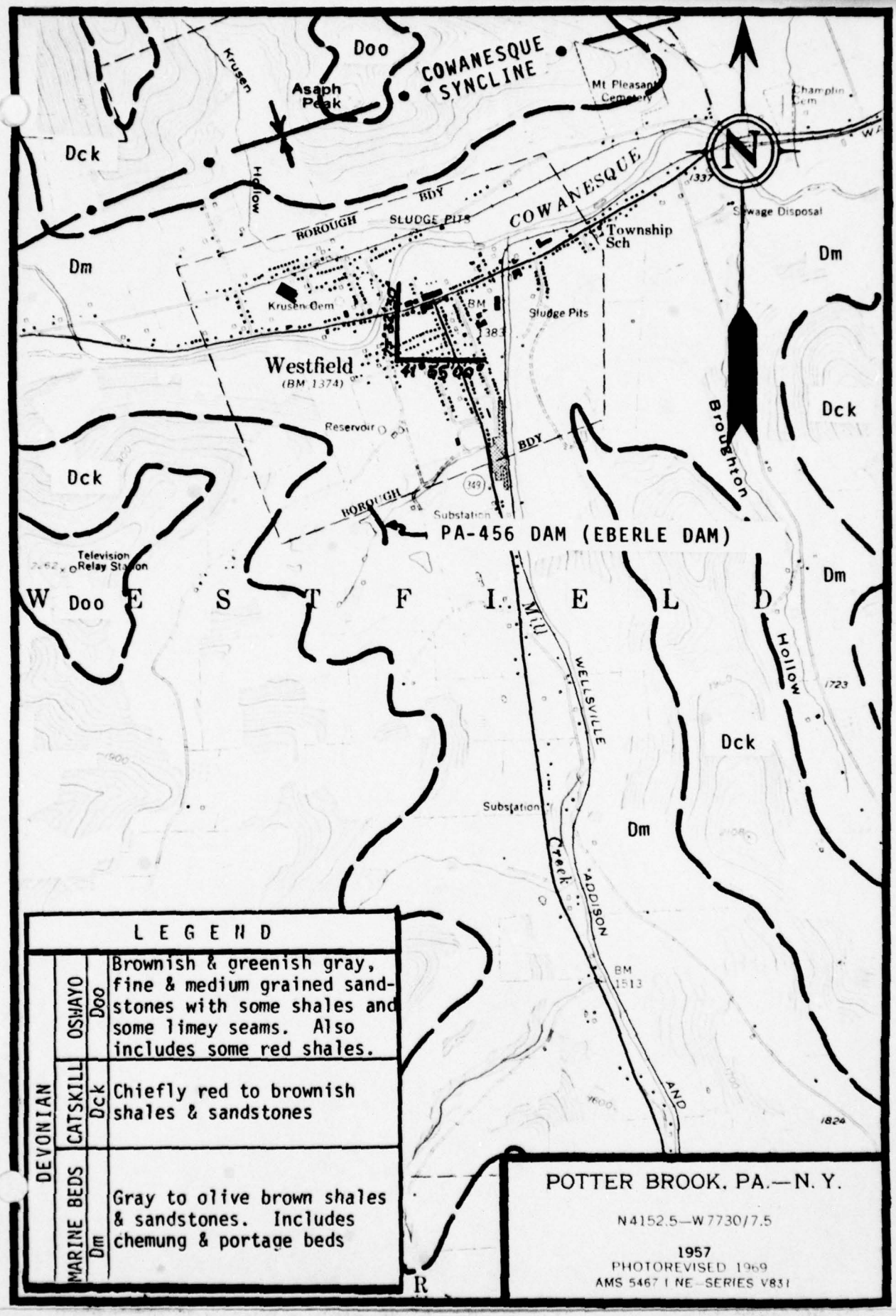
A detailed subsurface exploration program in the form of test pits and borings was conducted beneath the foundation area of the embankment, principal spillway, emergency spillway and borrow area. Results of this program indicate the site is covered by a thick deposit of glacial soils. The deepest boring drilled at the lowest topographic elevation along the embankment crest centerline was extended 65 feet below the ground surface and was terminated in glacial sand and gravel. No borings or test pits were extended into the bedrock underlying the site.

The drilling and test pit program indicates the entire site is covered by a thin mantle, approximately 3-1/2 feet

in thickness, of glacial drift consisting of a dry to moist, compact gravelly sand-clay. Underlying this blanket are glaciolacustrine sediment deposited by an ancient glacial lake. These deposits are typically composed of moist, soft to firm, gray brownish clay with 1/4 inch to 1/2 inch thick laminations of very fine sand with no gravel. Locustrine clay and sands were found beneath the till mantle throughout the borrow area.

Along the centerline of the dam at the deepest embankment section test pit and boring data suggested that the original stream had eroded a deep cut in the laminated lake deposits which was subsequently filled with gravelly clay, silt, sand, and some cobbles.

Explorations on the right abutment show the laminated lake deposit to be underlain by very compact clayey silts with boulders and rock fragments. This suggests that prior to the development of the glacial lake deposits, a glacial outwash condition existed which covered the area with a poorly sorted till composed of sand, gravel, silt, and clay mixtures.



POTTER BROOK, PA.—N. Y.

N4152.5—W7730/7.5

1957
PHOTOREVISED 1969
AMS 5467 I NE—SERIES V831

APPENDIX F

FIGURES

LIST OF FIGURES

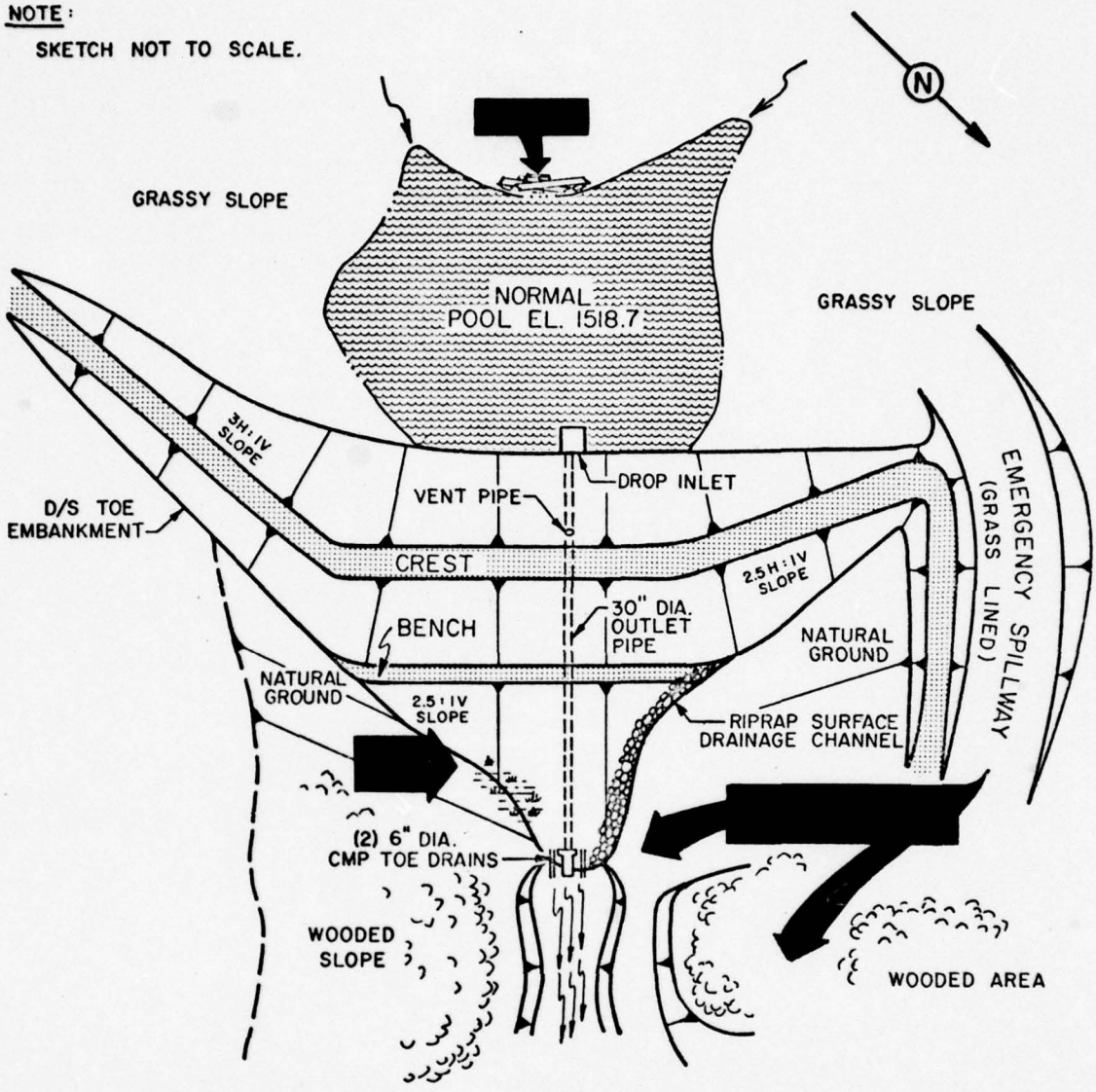
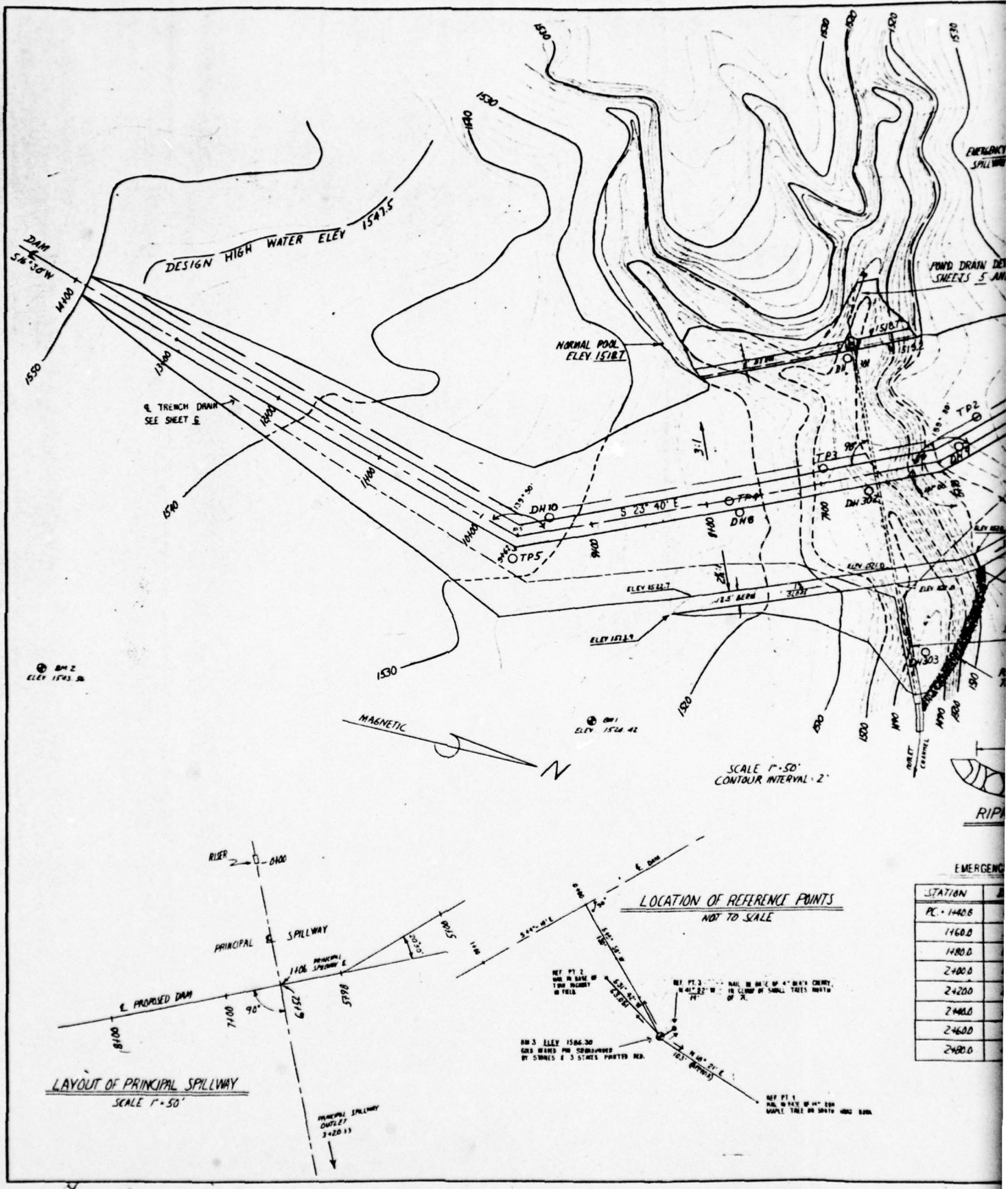


FIGURE 1 - PA-456 DAM

GENERAL PLAN

FIELD INSPECTION NOTES



LAYOUT OF PRINCIPAL SPILLWAY
SCALE 1"=50'

LOCATION OF REFERENCE POINTS
NOT TO SCALE

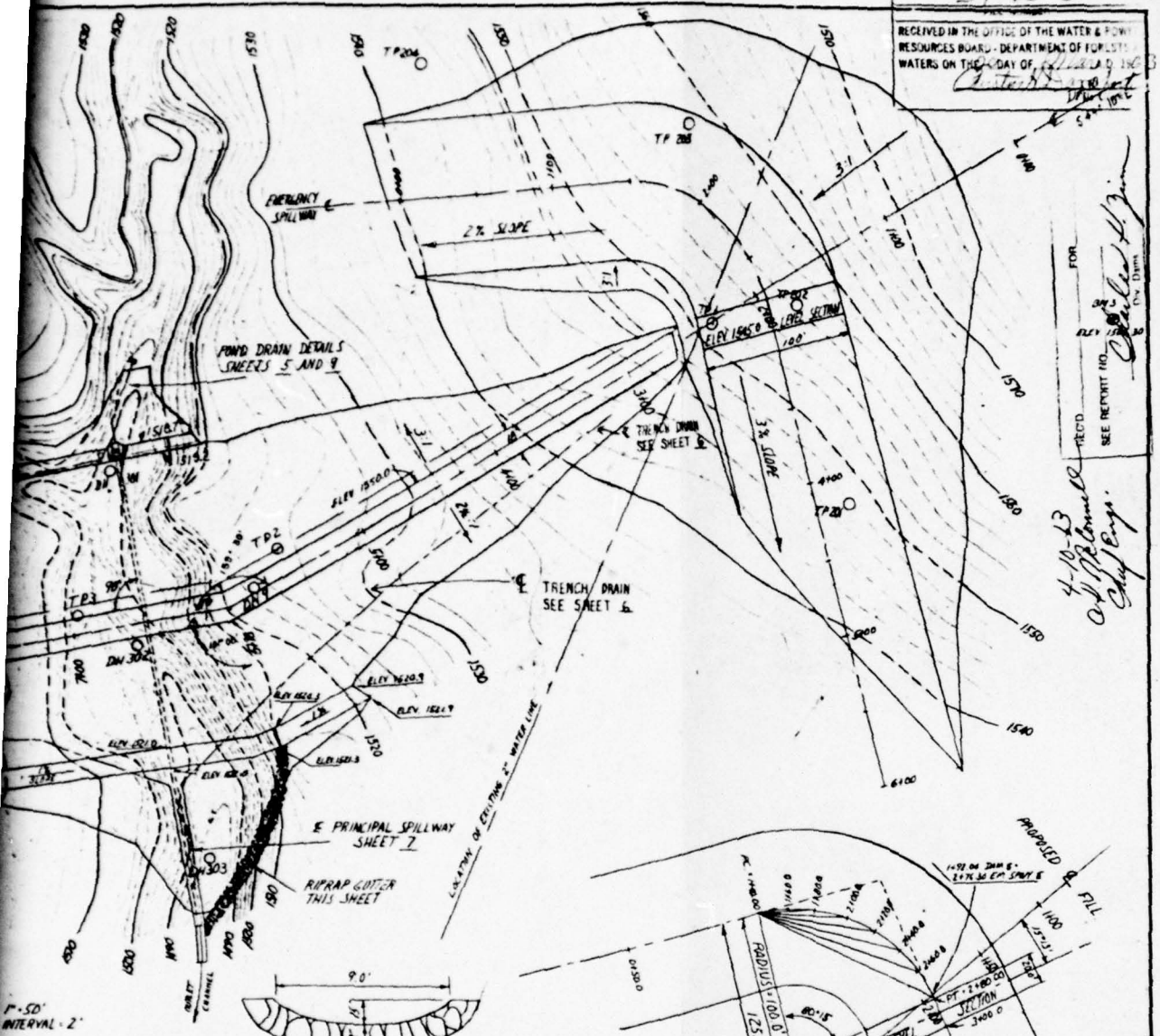
EMERGENC

STATION	
PC = 1420.8	
1460.0	
1480.0	
2400.0	
2420.0	
2440.0	
2460.0	
2480.0	

59-635

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD - DEPARTMENT OF FORESTS & WATERS ON THE [illegible] DAY OF [illegible] 1963

2



RIPRAP GUTTER DETAIL

LAYOUT OF EMERGENCY SPILLWAY
SCALE 1" = 50'

EMERGENCY SPILLWAY CURVE DATA

STATION	DEFL Δ	CHORD
PC = 1440.0	0°00'	0
1460.0	5°44'	20.0'
1480.0	11°28'	20.0'
2400.0	17°12'	20.0'
2420.0	22°56'	20.0'
2440.0	28°40'	20.0'
2460.0	34°24'	20.0'
2480.0	40°07½'	20.00

R = 100.00'
Δ = 80°15'
La = 140.0'
Lc = 128.8'
T = 84.3'
M = 23.5'
E = 30.8'
PC = 1490.0
PT = 2480.0

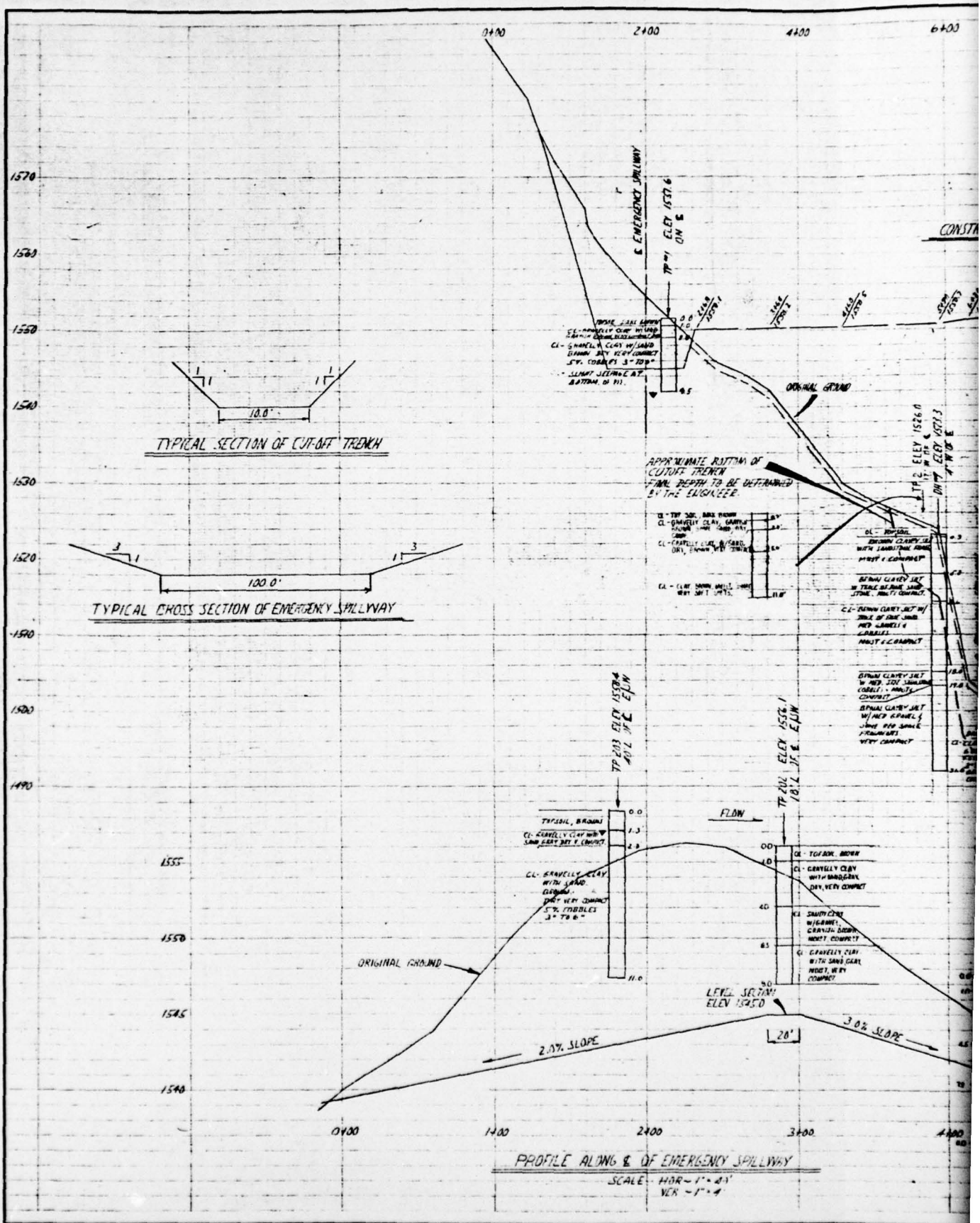
FIGURE 2

MILL CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA
PLAN OF DAMSITE

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	E.U. GINGRICH	APR 63	Approved by
	J.V. RISZDORFER	JUNE 61	Title
Drawn	G.E. VAN BUSKIRK	JAN '63	Title
Traced			Sheet No. 3 of 11 sheets
Checked		Mar 63	Drawing No. PA-456-P

Form SCS 313 (November 1955)


0400
2400
4400
6400
1570
1560
1550
1540
1530
1520
1510
1500
1490
1555
1550
1545
1540
0400
1400
2400
3400
4400
1
1
1
1
10.0'
TYPICAL SECTION OF CUT-OFF TRENCH
3
1
1
3
100.0'
TYPICAL CROSS SECTION OF EMERGENCY SPILLWAY
℄ EMERGENCY SPILLWAY
TP #1 ELEV 1537.6 ON ℄
ORIGINAL GROUND
APPROXIMATE BOTTOM OF CUTOFF TRENCH FINAL DEPTH TO BE DETERMINED BY THE ENGINEER
TP #2 ELEV 1526.0 11' W OF ℄
ORIG ELEV 1517.3
TP #3 ELEV 1550.4 40.2' N OF ℄
TP #4 ELEV 1536.1 18.2' N OF ℄
FLOW
TOPSOIL, BROWN
CL - GRAVELLY CLAY WITH SAND, DRY, VERY COMPACT
5% COBBLES 3" TO 6"
CL - GRAVELLY CLAY WITH SAND, BROWN, DRY, VERY COMPACT
CL - SANDY CLAY, W/GRAVEL, BROWN, MOIST, COMPACT
CL - GRAVELLY CLAY WITH SAND CLAY, MOIST, VERY COMPACT
ORIGINAL GROUND
LEVEL SECTION ELEV 1545.0
20'
2.0% SLOPE
3.0% SLOPE
PROFILE ALONG ℄ OF EMERGENCY SPILLWAY
SCALE: HOR - 1" = 40'
VER - 1" = 4'

79-6354 2

FILE NUMBER

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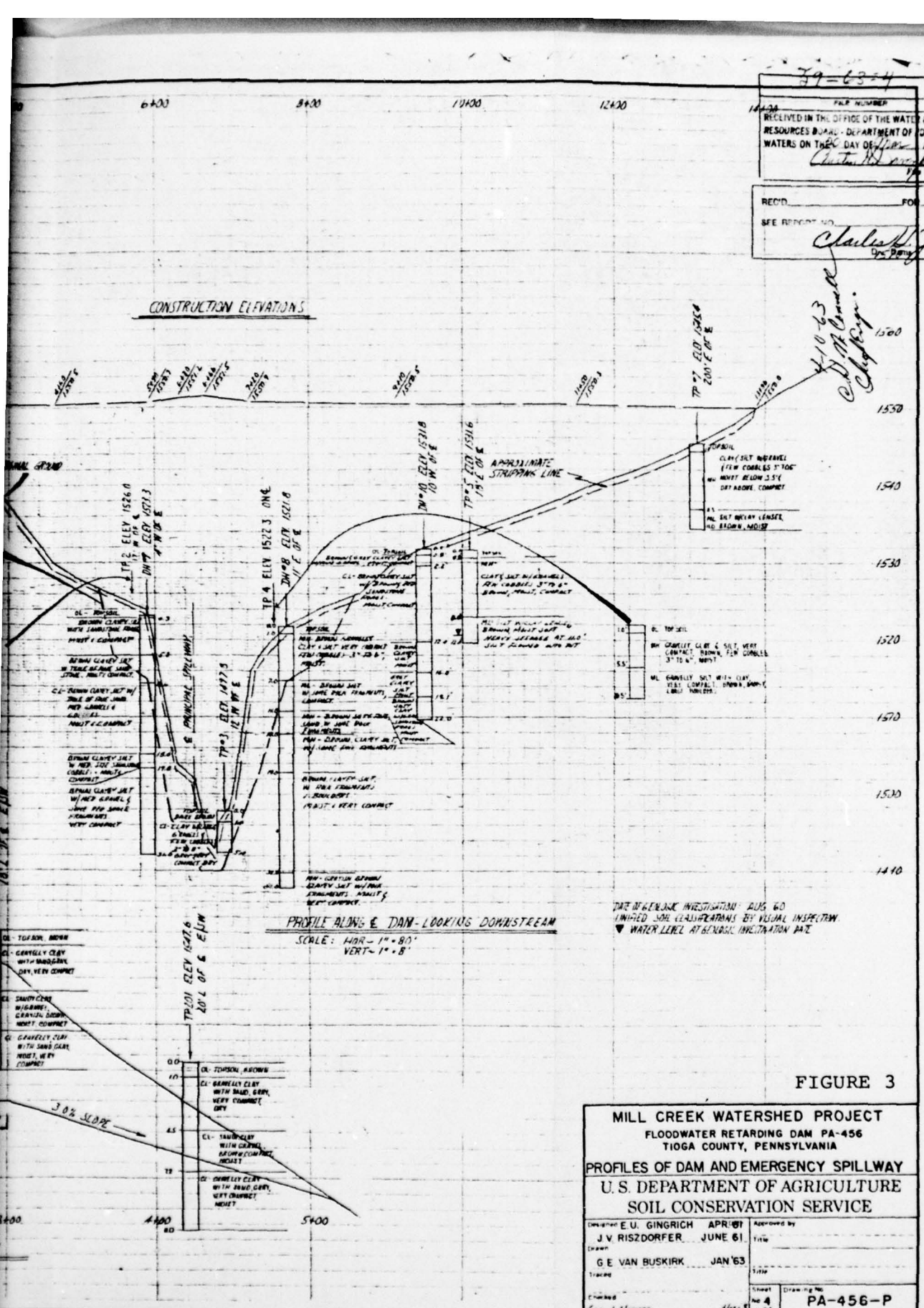
For Clerk

RECD. ... FOR

SEE REPORT NO. ...

Charles L. Jones
Dpty. Secy.

CONSTRUCTION ELEVATIONS



PROFILE ALONG ℄ DAM - LOOKING DOWNSTREAM

SCALE: HOR. - 1" = 80'
VERT. - 1" = 8'

DATE OF GEOLOGIC INVESTIGATION: AUG. 60
UNIFIED SOIL CLASSIFICATIONS BY VISUAL INSPECTION
▼ WATER LEVEL AT GEOLOGIC INVESTIGATION DATE

FIGURE 3

MILL CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA

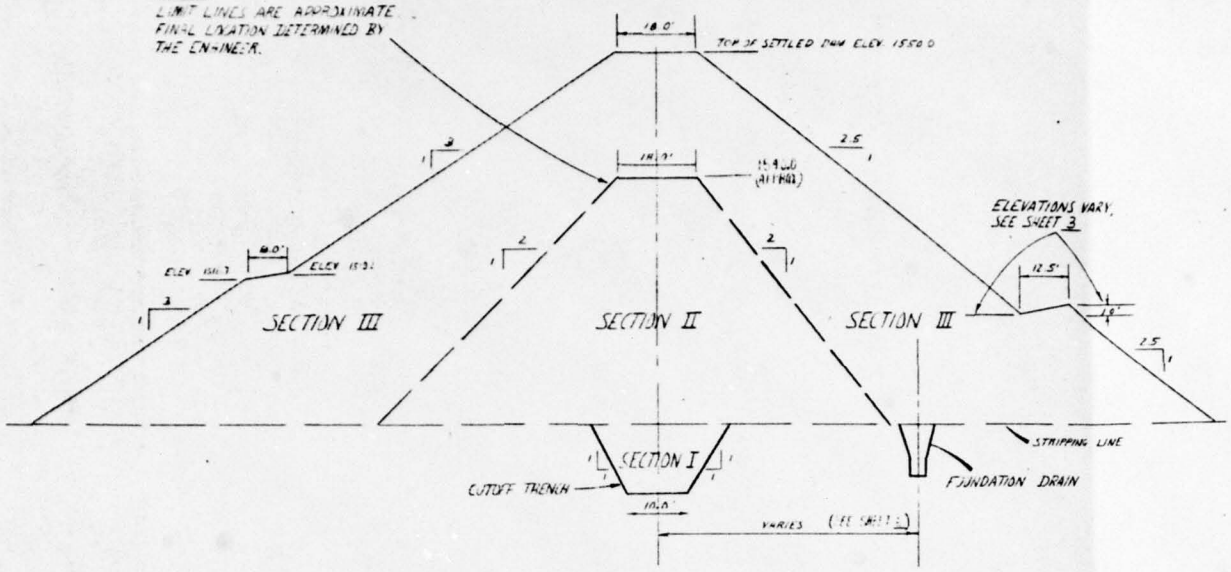
PROFILES OF DAM AND EMERGENCY SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

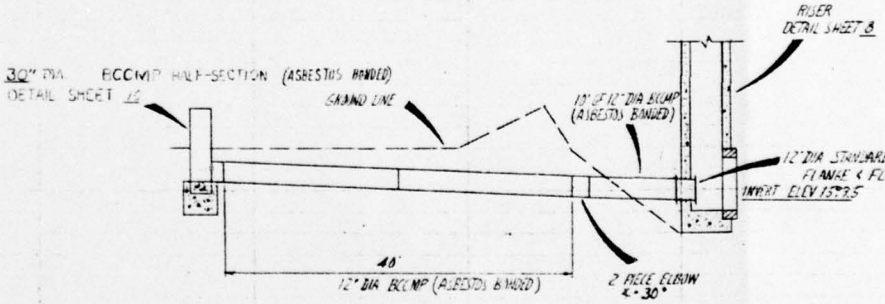
Designed E.U. GINGRICH APR '61 J.V. RISZDORFER JUNE 61	Approved by Title		
Drawn G.E. VAN BUSKIRK JAN '63	Title		
Traced			
Checked Geo. J. Hyzer	Sheet No. 4 of 11 sheets	Drawing No. PA-456-P	

Form SCS-316 (November 1955)

NOTE
LIMIT LINES ARE APPROXIMATE. FINAL LOCATION DETERMINED BY THE ENGINEER.



TYPICAL SECTION OF DAM
(NOT TO SCALE)



PROFILE ALONG ℄ OF POND DRAIN
SCALE: HOR ~ 1" = 10'
VERT ~ 1" = 4'

SECTION I CLASS B-2 FILL
MATERIAL REPRESENTED BY THE LOG OF TP-204 FROM 3.0' TO 7.0'; TP-104 FROM 1.0' TO 3.0'; TP-5 FROM 8.0' TO 12.0'

SECTION II CLASS B-2 FILL
MATERIAL REPRESENTED BY THE LOG OF TP-104 FROM 3.0' TO 12.0'

SECTION III CLASS B-2 FILL
COARSE GRAIN MATERIAL REPRESENTED BY THE LOGS TP-5 FROM 1.0' TO 8.0', TP-201 FROM 1.0' TO 4.0'; TP-203 FROM 2.0' TO 11.0'; TP-103 FROM 4.0' TO [illegible]

THE SUITABILITY OF FILL MATERIAL WILL AT ALL TIMES BE SUBJECT TO APPROVAL BY THE ENGINEER. (SPEC 5-PAR 5.6)

59-63-5

RECEIVED IN THE OFFICE OF THE WATER RESOURCES BOARD - DEPARTMENT OF FOR WATERS ON THE [illegible] DAY OF [illegible] A.D. 63
[illegible]
Pile Clerk

FILED [illegible] FOR [illegible]
SEE REPORT NO. [illegible]
[illegible]
Div. Engr.

2

[illegible] 1963
[illegible]
Asst. Engr.

[illegible]
[illegible] SHEET 8

[illegible] STANDARD WALL CASTING
[illegible] FLANGE & FLANGE (SEE SHEETS 7 & 8)
[illegible] 1573.5

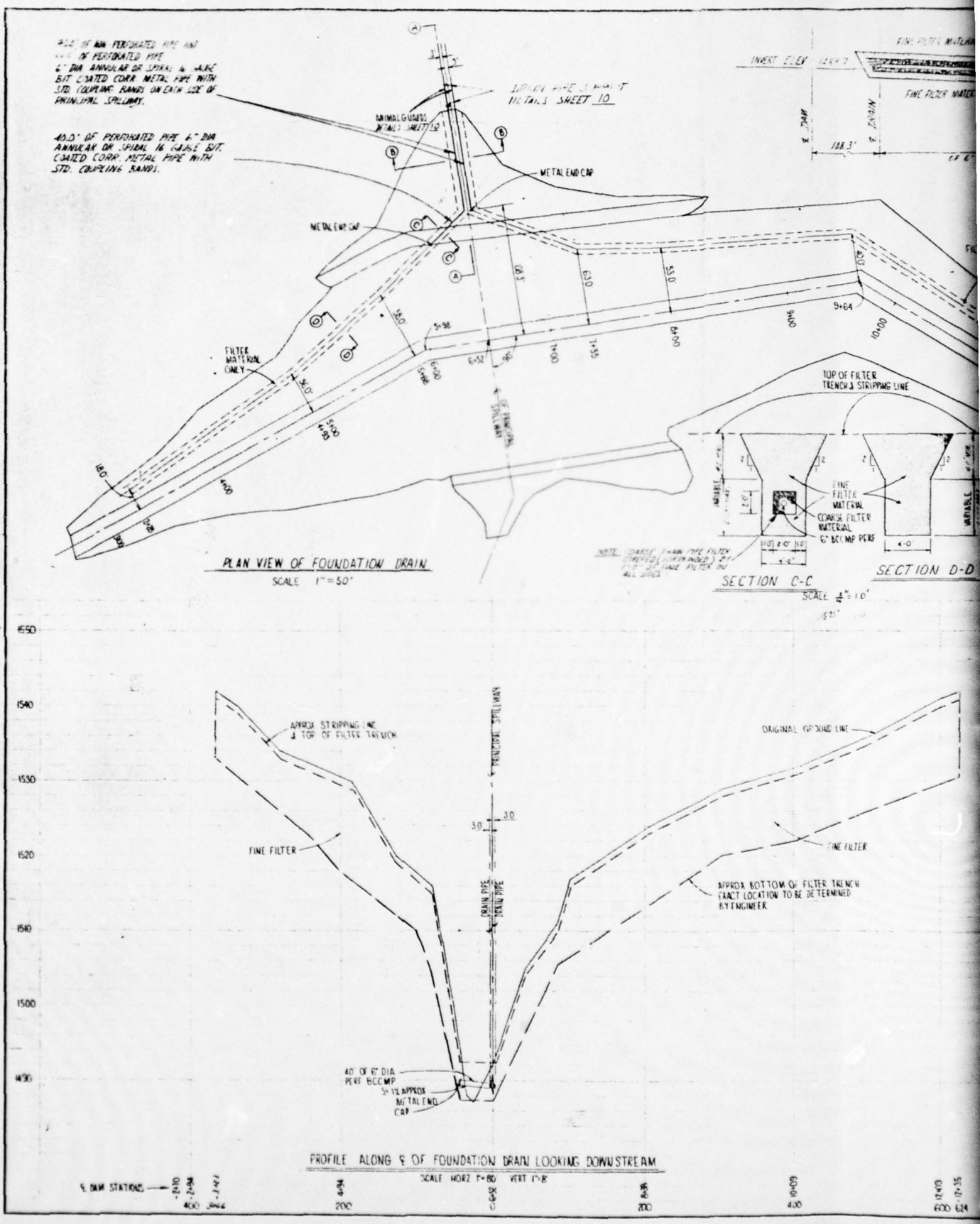
FIGURE 4

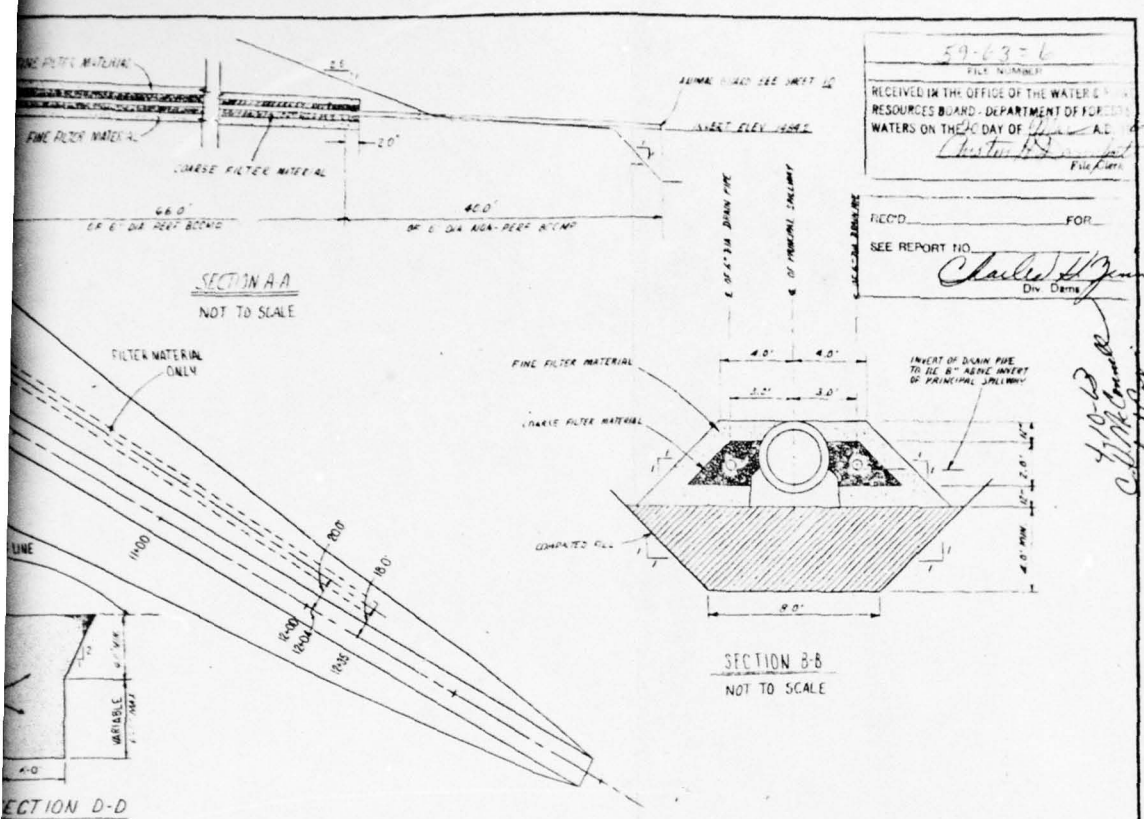
MILL CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA

PROFILES OF POND DRAIN —TYPICAL SECTION OF DAM

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed: E.U. GINGRICH APR. '61	Approved by:	
J.V. RISZDORFER JUNE 61	Title:	
Drawn: G.E. VAN BUSKIRK JAN. '63	Title:	
Traced:		
Checked: [illegible] Asst. [illegible]	Sheet No. 3 of 11 sheets	PA-456-P


PLAN VIEW OF FOUNDATION DRAIN
SCALE 1"=50'
SECTION C-C
SECTION D-D
PROFILE ALONG ℄ OF FOUNDATION DRAIN LOOKING DOWNSTREAM
SCALE HORZ 1"=80 VERT 1"=8'
ORIGINAL GROUND LINE
FINE FILTER
APPROX BOTTOM OF FILTER TRENCH EXACT LOCATION TO BE DETERMINED BY ENGINEER
APPROX STRIPPING LINE & TOP OF FILTER TRENCH
PROJECTED SPILLWAY
DRAIN PIPE
40 OF 6" DIA PERF BCOMP
APPROX METAL END CAP
METAL END CAP
FILTER MATERIAL ONLY
TOP OF FILTER TRENCH & STRIPPING LINE
FINE FILTER MATERIAL
COARSE FILTER MATERIAL
6" BCOMP PERF
℄ DRAIN STATIONS



59-637

FILE NUMBER

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File Clerk

REC'D _____ FOR _____

SEE REPORT NO. _____

Charles H. Jenn
Div. Dams

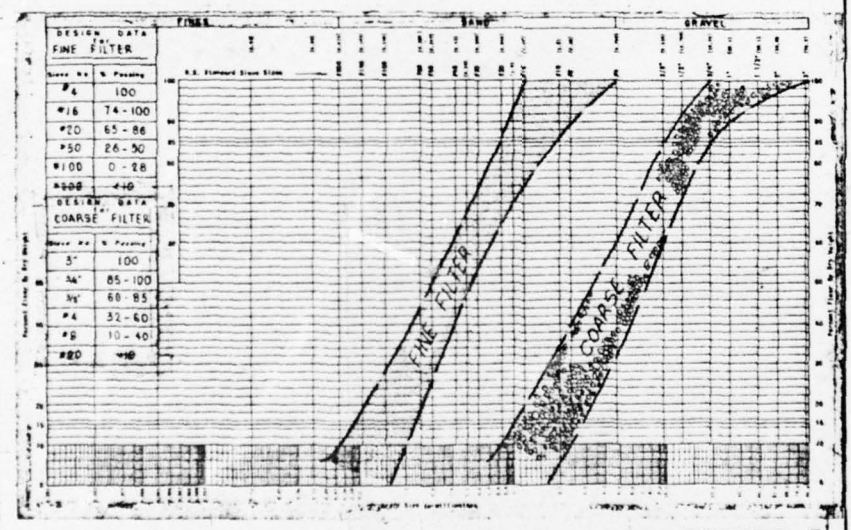


FIGURE 5

MILL CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA
FOUNDATION DRAIN DETAILS

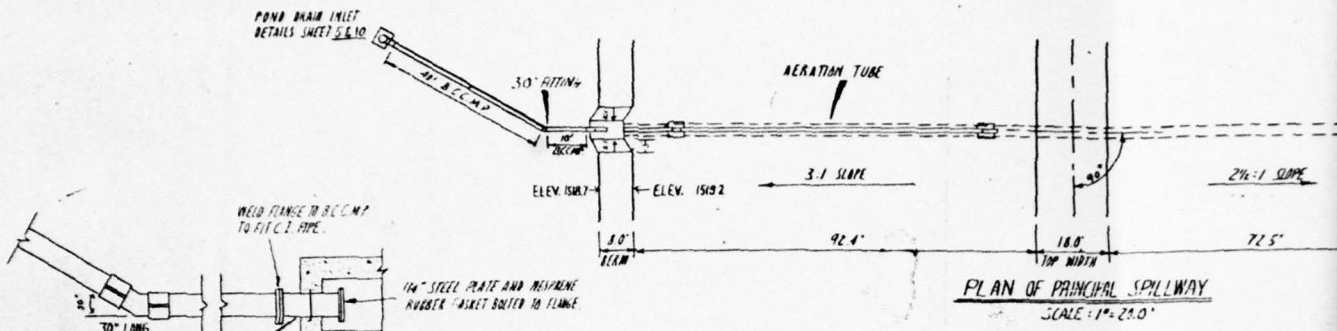
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed E.U. GINGRICH APR. '61
J.V. RISZDORFER JUNE 61
Drawn R.A. STALTER JAN. '63
Traced
Checked

Approved by
Title
Title

Sheet No. 6 of 11

Drawing No. PA-456-P



PLAN OF PRINCIPAL SPILLWAY

SCALE: 1" = 20.0'

DETAIL "A"

SCALE ½" = 1.0'

POND DRAIN

50' OF 12" DIA ANNULAR OR SPIRAL ASBESTOS SEWER BIT-COATED METAL PIPE WITH STANDARD CONNECTING BANDS.

(1) POND DRAIN INLET.

(1) 30"-12" DIA FITTING

PRINCIPAL SPILLWAY

30" I.D. REINFORCED CON

(28) 16'-0" SECTIONS

(1) WALL PIECE FOR 12"

TOTAL OF 321.33'

PRESSURE HEAD = 50.0'

LOAD = 37,734 LBS PER

MIN. 3 EDGE BEARING ST

0.01" CRACK (NON-PRES

0.001" CRACK (PRESTRE

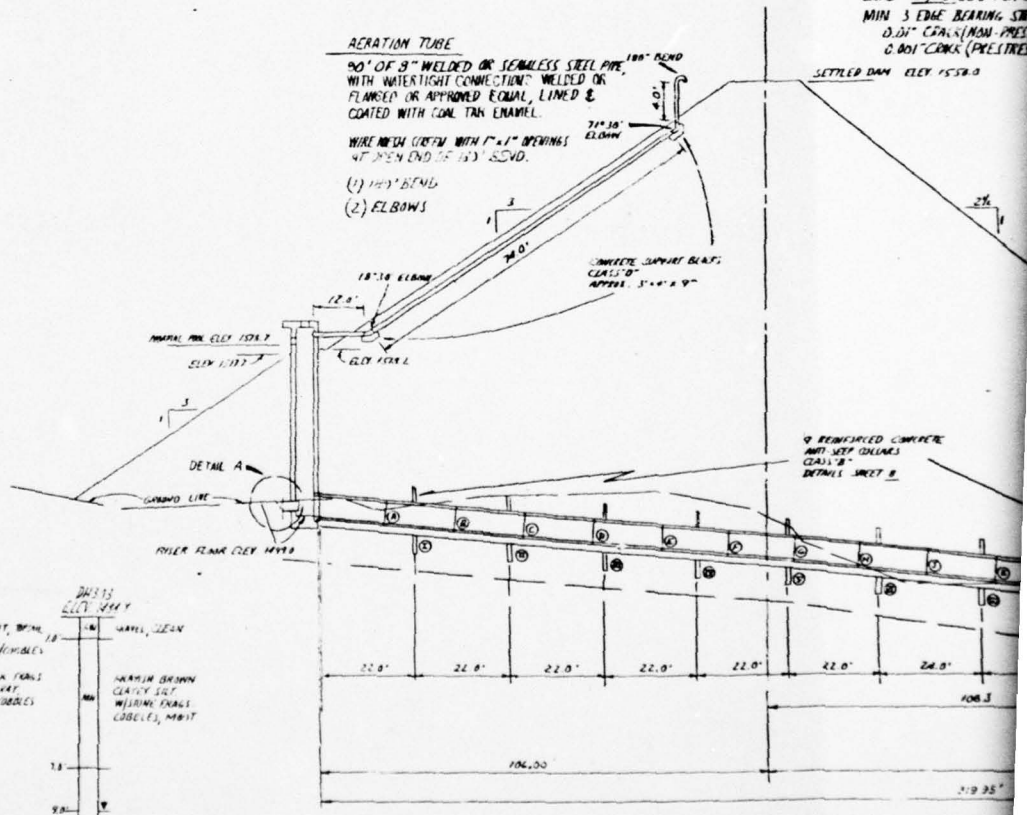
AERATION TUBE

90' OF 8" WELDED OR SEAMLESS STEEL PIPE, WITH WATERTIGHT CONNECTIONS WELDED OR FLANGED OR APPROVED EQUAL, LINED & COATED WITH COAL TAR ENAMEL.

WIRE MESH SCREEN WITH 1" x 1" OPENINGS AT OPEN END OF 45° ELBOW.

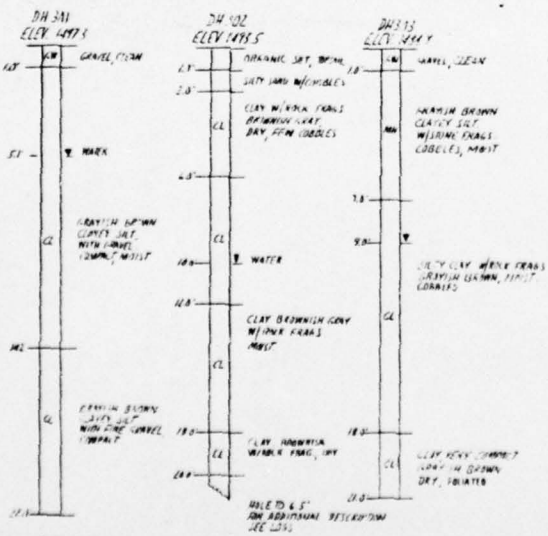
(1) 180° BEND

(2) ELBOWS



PROFILE OF PRINCIPAL SPILLWAY

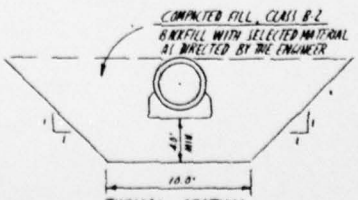
SCALE 1" = 20' HOR.
1" = 10' VERT.



DATE OF GEOLOGICAL INVESTIGATION - A316 (A3)

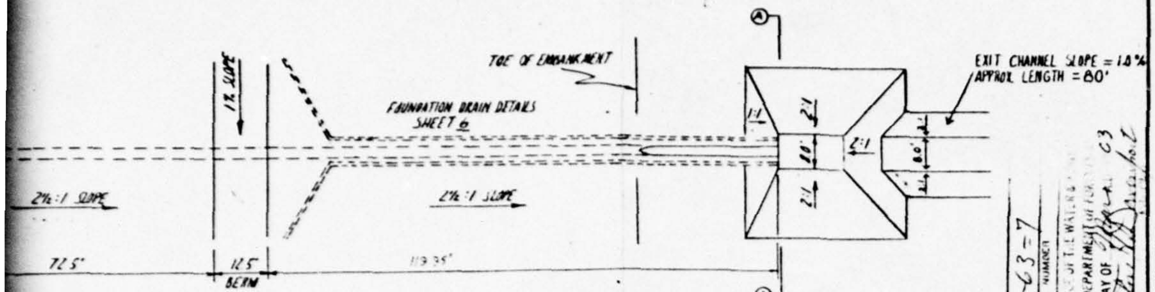
UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION

▼ WATER LEVEL AT GEOLOGIC INVESTIGATION DATE



TYPICAL SECTION
PRINCIPAL SPILLWAY EXCAVATION

NOT TO SCALE



ANTI-SEEP COLLAR DATA

POINT	DISTANCE FROM RISER WALL PIECE	INVERT ELEVATION OF 30" I.D. WATER PIPE
I	22	1498.03
II	44	1497.05
III	66	1496.08
IV	88	1495.10
V	110	1494.13
VI	132	1493.02
VII	156	1491.79
VIII	180	1490.56
IX	204	1489.33

PIPE JOINT DATA

POINT	DISTANCE FROM RISER WALL PIECE	INVERT ELEVATION OF 30" I.D. WATER PIPE	SLOPE
RISER	0	1499.00	0.0445
A	16	1498.29	
B	32	1497.59	
C	48	1496.87	
D	64	1496.16	
E	80	1495.46	
F	96	1494.75	
G	112	1494.04	
H	128	1493.22	0.0512
J	144	1492.40	
K	160	1491.58	
L	176	1490.77	
M	192	1489.95	
N	208	1489.13	
O	224	1488.31	
P	240	1487.49	
Q	256	1486.67	
R	272	1485.86	
S	288	1485.04	
T	304	1484.22	
OUTLET	320	1483.40	

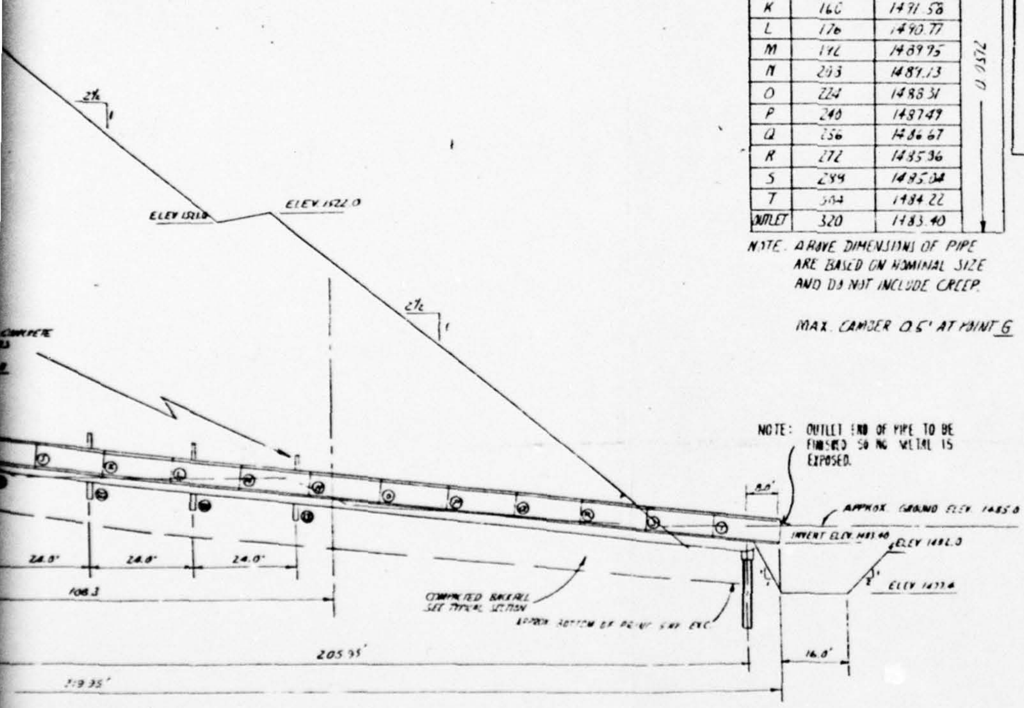
NOTE. ABOVE DIMENSIONS OF PIPE ARE BASED ON NOMINAL SIZE AND DO NOT INCLUDE CREEP.

MAX. CAMBER 0.5' AT POINT G

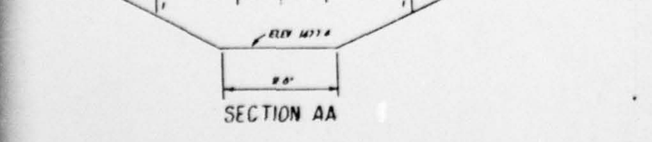
...CIPAL SPILLWAY:
...I.D. REINFORCED CONCRETE WATER PIPE
...16'-0" SECTIONS
...WALL PIECE FOR 12" WALL
...L OF 321.33'
...SSURE HEAD = 50.0'
... = 37,724 LBS PER LIN. FT. BASED ON O.D. OF 37"
3 EDGE BEARING STRENGTH FOR
...01" CRACK (NON-PRESTRESSED PIPE) = 12,768 LBS PER LIN. FT.
...001" CRACK (PRESTRESSED PIPE) = 9600 LBS PER LIN. FT.

59-63-7
FILE NUMBER
RECEIVED IN THE OFFICE OF THE WATER AND POWER RESOURCES BOARD, DEPARTMENT OF FORESTS AND WATERS ON THE 20 DAY OF ... 63

REC'D ____ FOR ____
SEE REPORT NO. ____
Div. Dams



...SPILLWAY



SECTION AA

FIGURE 6

MILL CREEK WATERSHED PROJECT

FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA

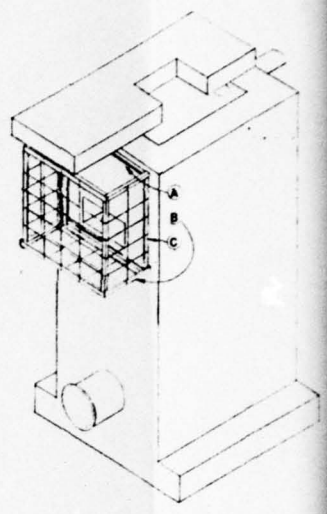
PLAN-PROFILE OF PRINCIPAL SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

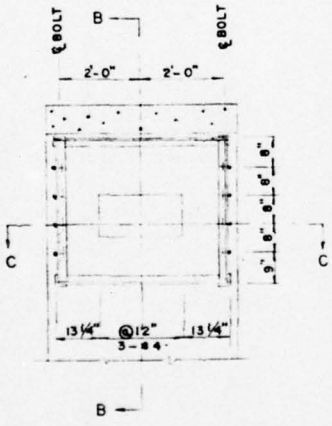
E.U. GINGRICH APR. 61
J.V. RISTDORFER JUNE 61
C.E. VAN BUSKIRK JAN. '63

7
11

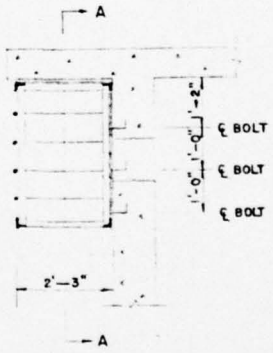
PA-456-P



ISOMETRIC VIEW



SECTION A-A



SECTION B-B

59-6-3-9
FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD - DEPARTMENT OF FORESTS & WATERS ON THE 10 DAY OF May A.D. 1963

File Clerk

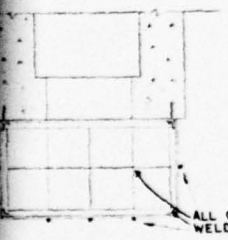
REC'D _____ FOR _____

SEE REPORT NO. _____

Div. Dams

4-10-63
C. J. McConnell
Asst. Engr.

2



BILL OF MATERIALS

LOCATION	ITEM	SIZE	LENGTH	QUANTITY
TRASH RACK	ANGLE IRON A	2"X2"X¼"	4'-2"	4
	ANGLE IRON B	2"X2"X¼"	2'-3"	4
	ANGLE IRON C	2"X2"X¼"	3'-5"	4
	REINFORCING BAR	# 4	4'-2"	5
	REINFORCING BAR	# 4	2'-3"	11
	REINFORCING BAR	# 4	3'-5"	5
	GALV ANCHOR BOLT W/NUTS & WASHERS	3/4" Dia.		6

NOTE: FOR GALVANIZED ANCHOR BOLT DETAIL SEE SHEET 10 OF 11

SECTION C—C

3'—5"
1'—0" 1'—0" 5"

½" SLOTS

2 SLOTTED (BACK ANGLE IRONS)
2 WITHOUT SLOTS (FRONT ANGLE IRONS)

LE IRON C

SCALE: ½"=1'-0"

FIGURE 7

MILL CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM PA-456
TIOGA COUNTY, PENNSYLVANIA

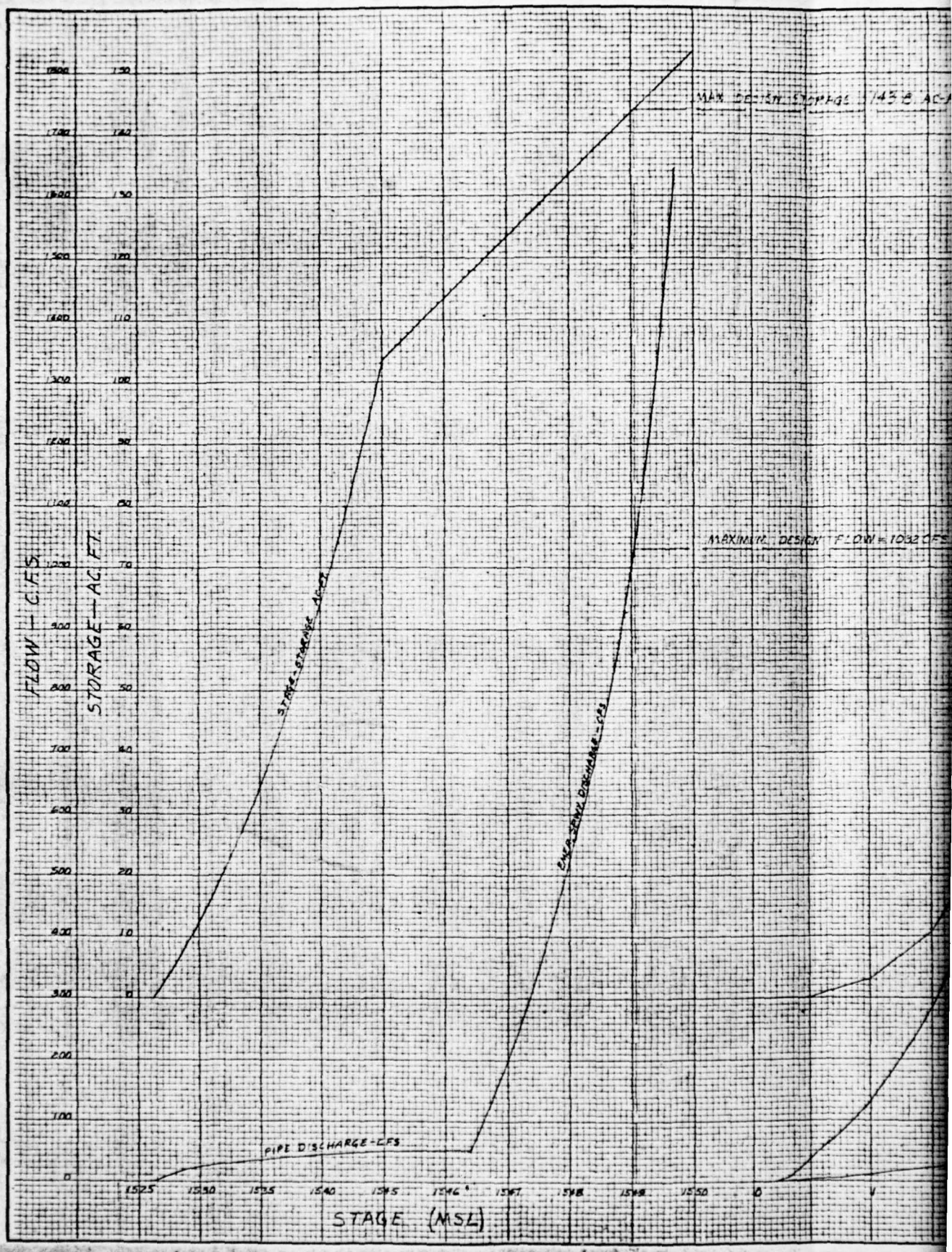
TRASH RACK

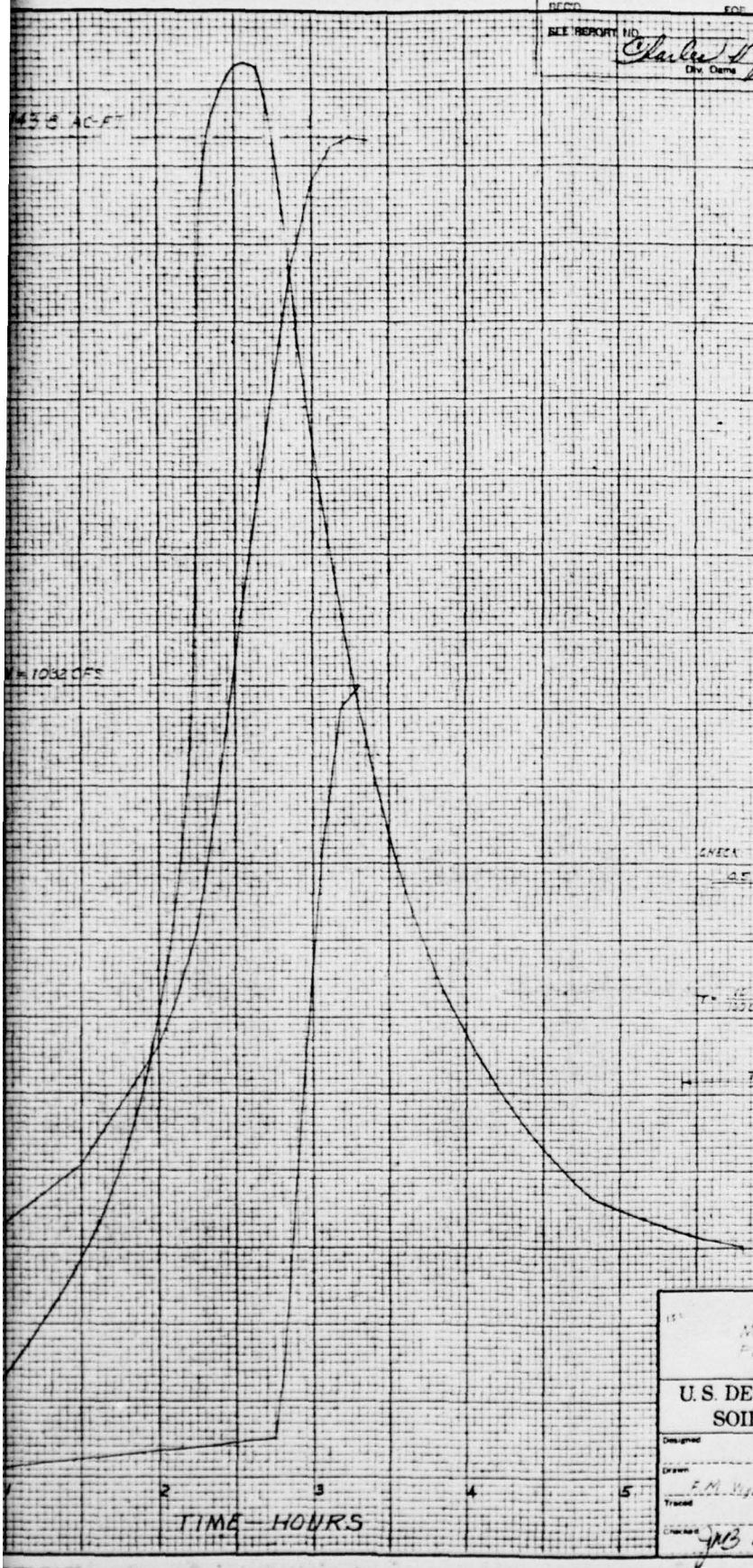
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

J. V. RISZDORFER JUN '61
R. MAYS JAN '63

SHEET 9 OF 11

PA-456-P


MAX DESIGN STORAGE 143.8 AC-
MAXIMUM DESIGN FLOW = 1032 CFS
STAGE-STORAGE-AC-FT
ENCASEMENT DISCHARGE-CFS
PIPE DISCHARGE-CFS
FLOW - C.F.S.
STORAGE - AC. FT.
STAGE (MSL)
1525
1530
1535
1540
1545
1546
1547
1548
1549
1550



RECD. FOR

SEE REPORT NO. Charles L. Jones Div. Clerk

59-63-12 FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF PUBLIC WORKS, STATE OF PENNSYLVANIA ON THIS 2 DAY OF [illegible] A.D. 1963

Dep. Clerk

2

HYDROLOGIC DATA

1.	CLASS STRUCTURE	C	
2.	DRAINAGE AREA	0.6	SQ. MI.
3.	RAINFALL	10.9	IN.
4.	RUNOFF	3.16	IN.
5.	T_c	0.83	HR.
6.	CURVE NO.	90	
7.	MOISTURE COND.	III	

NOTE:

DESIGN HIGH WATER SET AT 1647.6
PERMANENT POOL LOWERED TO
ELEVATION 1518.7

* Note:
Drain lowered by 15 ac.-ft.
Storage = amount of storage
by which permanent pool
reduced - OK JHB

4-10-63
C. L. Jones
Chief Engr.

CHECK

$$\frac{0.6 \text{ MI}^2 \times 10.9 \text{ IN} \times 3601 \text{ FT}^2/\text{HR} \times 2.6 \text{ HR}}{43560 \text{ FT}^2/\text{AC-FT}} = 1445.2 \text{ AC-FT} = (0.56\% \text{ ERROR})$$

$$T = \frac{12 \text{ AC-FT} \times 43560 \text{ FT}^3/\text{AC-FT}}{1032 \text{ FT}^3/\text{SEC} \times 3600 \text{ SEC/HR}} = 1.41 \text{ HR.}$$

$T = 1.4$ HR.

FIGURE 8

DESIGN FLOOD ROUTING
MILL CREEK WATERSHED
PROTECTION PROJECT PA-456
TIOGA COUNTY, PA.

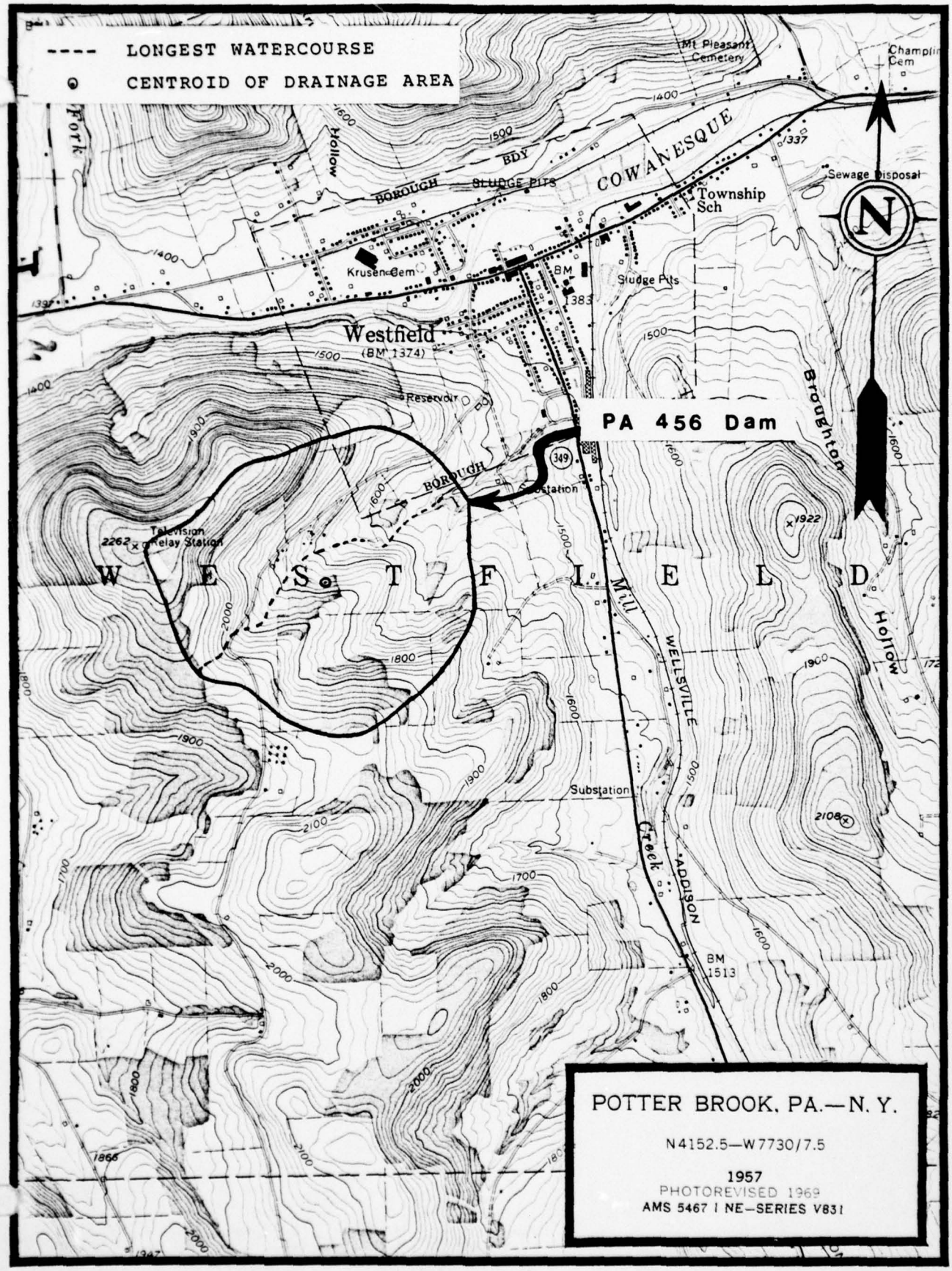
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn		Title	
F.M. Wysong	11-61	Title	
Traced			
Checked JHB	2/1/62	Sheet No. 1 of	Drawing No. PA-456

Form SCS-[illegible] (November 1955)

APPENDIX G

REGIONAL VICINITY MAP


---- LONGEST WATERCOURSE
⊙ CENTROID OF DRAINAGE AREA
Mt Pleasant Cemetery
Champlin Cem
Fork
Hollow
BDY
BOROUGH
SLUDGE PITS
COWANESQUE
Township Sch
Sewage Disposal
N
Krusen Cem
BM
1383
Sludge Pits
Westfield
(BM 1374)
Reservoir
PA 456 Dam
Broughton
BOROUGH
Substation
Television Relay Station
2262
W E S T F I E L D
Mill
WELLSVILLE
Hollow
1922
Substation
Creek
ADDISON
BM
1513
2108
1866
POTTER BROOK, PA.—N. Y.
N4152.5—W7730/7.5
1957
PHOTOREVISED 1969
AMS 5467 I NE—SERIES V831